SCIENTIFIC AMERICAN

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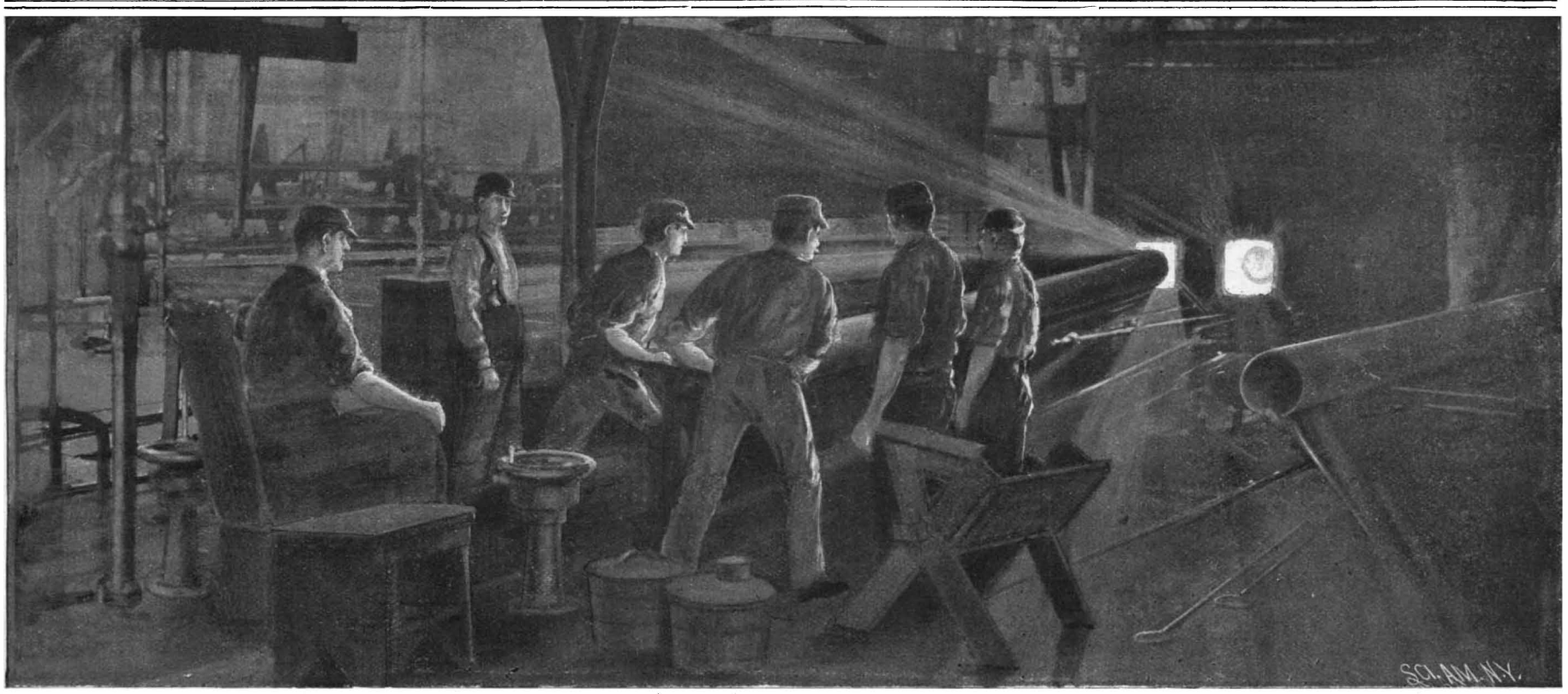
A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

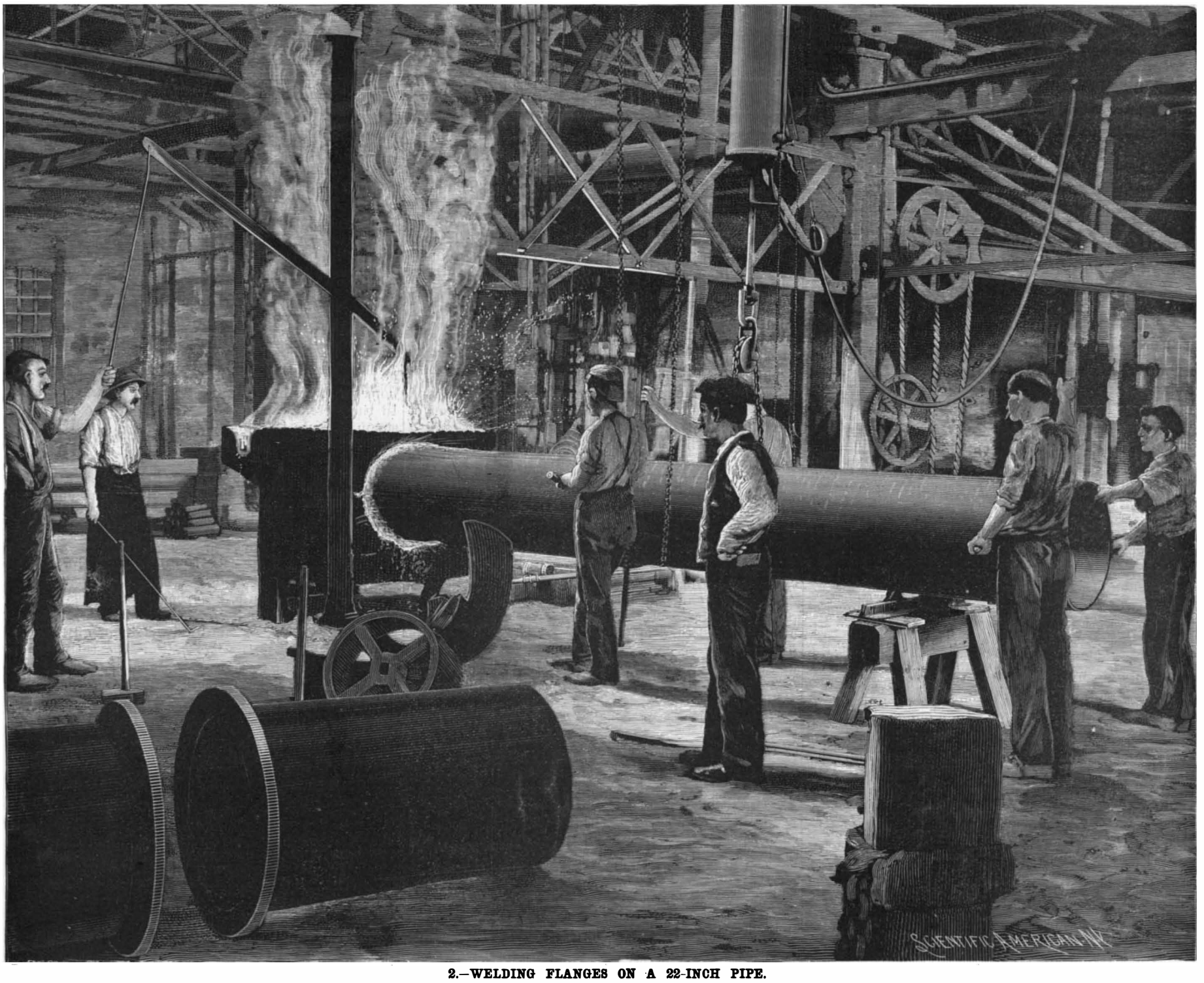
Vol. LXXVII.—No. 25.
ESTABLISHED 1845.

NEW YORK, DECEMBER 18, 1897.

[$3.00 A YEAR.
WEEKLY.



1.—PUSHING THE SKELP INTO THE WELDING FURNACE.



2.—WELDING FLANGES ON A 22-INCH PIPE.

THE MANUFACTURE OF STEEL TUBING—PIPE MILLS AT THE NATIONAL TUBE WORKS, McKEESPORT, PA.—[See page 392.]

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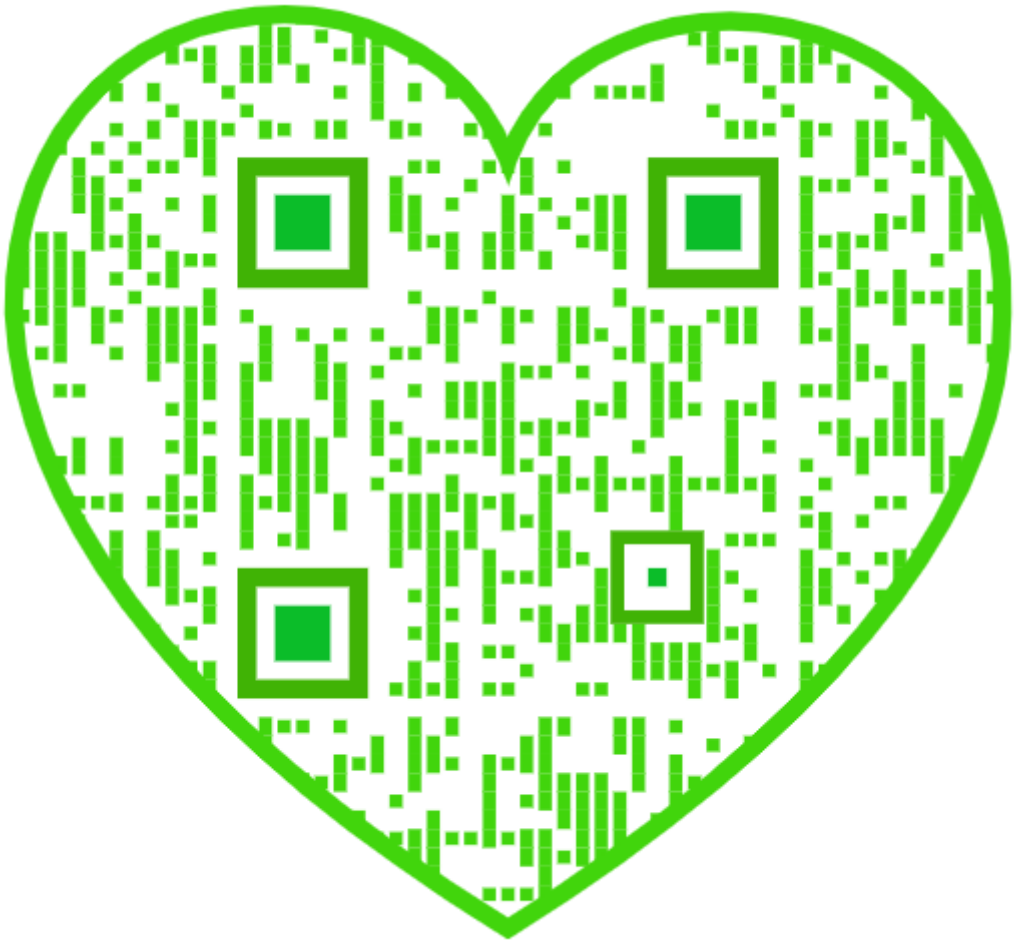

Scientific American.

ESTABLISHED 1845

MUNN & CO., - - - EDITORS AND PROPRIETORS.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, - - NEW YORK.

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(Established 1845.)

One copy, one year, for the U. S., Canada or Mexico.....**$3.00**
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(Established 1876)

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MUNN & CO., Publishers, 361 Broadway, New York.

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NEW YORK, SATURDAY, DECEMBER 18, 1897.

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CONDITION OF THE LABORING CLASSES IN MEXICO.

The discontent following the recent years of business depression has caused us to look about with a view to drawing comparisons with the social and commercial conditions of other nations and especially of those whose natural advantages, climatic, physical or political, bring them into comparison with our own people. We have involuntarily turned our eyes to Canada and Mexico, and especially toward the latter, owing to the fact that silver has been made the standard of value in that country, and because during the campaign of 1896 many allusions were made, by political speakers in various parts of the country, to the great prosperity of this neighboring republic. With a view to ascertaining the true condition of affairs as touching the civilization and social and commercial conditions of Mexico, Mr. Theodore C. Knauff made an extensive trip through this country. The question so often asked was, "Why is it that the Mexican peon, with his sixty cents a day, is making more than the American farmer with all his knowledge and invested capital?" In the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT we publish in full Mr. Knauff's lecture recently delivered under the auspices of the Franklin Institute, in Philadelphia, in answer to this question.

The author explains how little conception the ordinary citizens of the United States have of the extent of or even the natural and physical conditions which prevail in Mexico. The ignorance of our people concerning our neighbor of the south is almost incomprehensible. A map of Mexico projected on a map of the United States of the same scale extends from Maine to Texas. Mexico is sixteen times the size of New York State. Sonora equals Iowa and Ohio combined. Chihuahua equals Pennsylvania and New York combined. Mexico's mountain system is a continuation of the Andes, and widens out into two ranges, leaving in the middle a high flat table land from 4,000 to 8,000 feet above the level of the sea, while many volcanic peaks reach an altitude of 18,000 feet. The city of Mexico is 7,469 feet above sea level or nearly 1,200 feet higher than Mount Washington. Its inhabitants feel the altitude and the great dryness and rarefication of the air. The population of Mexico is about 12,500,000. The lecturer states that two-thirds of this number have never slept in a bed or worn stockings, and that they are able to live at a less expense per diem than it takes to keep the meanest farm horse. Many of the inhabitants wear a single garment called a "sarappe," or thick woolen garment, with a hole at the top through which the head is inserted. This garment forms at the same time the Mexican's coat, hat, and even his bed. The feet are usually bare or clothed in domestic sandals. The women wear a kind of cotton shawl over the head and shoulders, called a "robosa." "The Mexican farm laborers' conditions are inferior to those of the late slaves of our Southern States. Their huts have but one opening, no windows and dirt floors. When wishing to go to bed, they simply unroll their mats, and, without removing their clothing, lie down and go to sleep. The laborer has a certain wage and is given time and place to build himself a house. If he does not build it he has nothing with which to cover his head. The houses are built by the people who live in them. Some of the houses are mud roofed and others roofed by palms or banana leaves or some fiber that will shed moisture when necessary."

These adobe houses are made of large blocks of mud pressed into shape in a mould and then hardened and baked in the sun and laid in flat layers, one on top of the other. This method of construction makes quite a substantial building, which requires a long time, even in the rainy season, to become watersoaked. A church and plaza are required before a settlement can become a city. There are shops in the cities, but the business is largely conducted by peddlers and sidewalk merchants. It is a common thing to see a man working a modern sewing machine in the streets. All branches of trade are carried on outside of the houses. In the cities the houses of the better class are made of stone. Among the rich the rooms are furnished in great magnificence. Mexico is at the same time a land of millionaires, for the land is most unevenly divided among the people. Out of the total population of over twelve million, six thousand people own all the land, "with influence enough," says the lecturer, "to avoid practically all taxation, which falls on the poor." There is no "middle class," so called. The railroad by which one travels passes through one estate for a distance of eighty miles, which enormous landed property belongs to one individual. In another place is an estate of 1,500,000 acres, in another one of 250,000 acres. "At present," says the lecturer, "there is no possible danger of an uprising of the people, because the people are perfectly contented in their lot." If the peon has a few coppers in his pocket, he is perfectly happy, and does not feel compelled to go to work until he is driven to it by hunger or necessity.

Mr. Knauff not only gives a picture of the life, habits and customs of the people, but he also depicts at length the commercial growth of the country, its products and manufactures.

For several years American merchants and manufacturers have made earnest efforts to enlarge our trade with Mexico—especially since the completion of the direct all-rail route from the Rio Grande to the city of Mexico—and the commercial travelers and leading merchants of our principal cities are pretty well acquainted with the commercial and social conditions as they are and have been in Mexico. There has been, within a comparatively recent period, some improvement in this trade, and, owing to the introduction of American capital in mining and other enterprises, and an infusion of American enterprise in some departments of industry, there has been better promise than ever before that Mexico was in some degree awaking from its long period of lethargy. The decline of the past five years in the price of silver has, however, proved a serious setback to the progress of Mexico, for to this extent has been enhanced the price of all imports—silver being the main product and the standard of money of the country; and in like ratio has also been increased the interest payable on the national debt. The value of the imports for the year ended June 30, 1896, was $42,253,938, and the exports for the same period were $105,016,902, and the total debt of the country in American money was $213,600,000. Yet Mexico has now in operation about seven thousand miles of railway and over forty thousand miles of telegraph, nearly all of which is of comparatively recent construction, and, notwithstanding the decline in silver, there are many encouraging signs for those who have been so long looking for a better development of her industries and increased trade between Mexico and the United States.

THE SUPREMACY OF THE STEAM TURBINE.

If the compound steam turbine fulfills its present promise, it is likely that in certain branches of engineering it will hold absolute possession before many years have passed. It is announced in the Russian press that the Russian Admiralty has placed orders with the firm of Hawthorne, Leslie & Company, of Hebburn-on-Tyne, England, for the construction of two 38-knot torpedo boats built on the model of the Turbinia and propelled with turbine motors working on four shafts, each of which carries three propellers. This is eight knots faster than the fastest torpedo boat destroyers in the British navy.

Just how much courage is required on the part of the naval architect who signs his name to a contract for a 38-knot boat—38 knots is 44 miles an hour—is evident from a comparison of figures. The 300-ton "destroyers" just mentioned require 6,000 horse power to drive them at 30 knots an hour. At these high speeds the resistance of the water increases as something more than the cube of the speed. The cube of 38 is more than double the cube of 30, and hence the 6,000 horse power of a 300-ton destroyer would have to be raised to over 12,000 to enable her to catch one of the new torpedo boats. But 12,000 horse power reciprocating engines of the common type, with the necessary boilers and coal, would sink a 300-ton torpedo boat, supposing they could ever be stowed away in her hold.

Evidently then a speed of 38 knots involves a radical change in the accepted methods of propulsion. Some form of motor is necessary in which the weight per indicated horse power shall be reduced to a very low figure. Indicated horse power is the product of steam pressure and piston velocity. If either or both of these be increased, there will be a proportionate increase in horse power without a proportionate increase in weight. In the present type of high speed marine engines the steam pressure is as high as can be used to advantage, and the piston speed is as great as the reciprocating type of engine will allow.

The present year has seen the advent of a phenomenal little boat, the Turbinia, in which the problem appears to have been completely solved for speeds from 30 to 40 knots an hour. Steam turbines of the type designed by Mr. Parsons, son of Lord Rosse of telescope fame, were substituted for the ordinary reciprocating type of engine, and by driving them at a speed of 2,100 revolutions per minute, 1,576 horse power was realized from an engine weighing only $4\frac{1}{10}$ tons, or $5\frac{1}{10}$ pounds per horse power. As the total weight of all the machinery and boilers is only 28·7 tons, the turbines develop 55 horse power for every ton of machinery, and 384 horse power per ton of engines. Compare this with the latest battleships, which develop only 9½ horse power per ton of machinery, and 27 horse power per ton of engines.

In the trials just mentioned, the Turbinia's engines were handicapped by too small a steam pipe, the pressure being 200 pounds at the boiler and only 130 pounds at the turbines. This was remedied, and subsequent trials gave a speed of 35 knots with 2,400 indicated horse power. The corresponding figures for this horse power would be 83½ horse power per ton of all machinery and 585 horse power per ton of engines!

One feature that renders these turbines so unusually promising is their remarkable economy. The consumption of steam per horse power hour is only 14 pounds, as against from 18 to 21 pounds for the most economical reciprocating engines, working under favorable conditions. It is evident that at the present

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stage the steam engine, as represented by those of the turbine type, is far in advance of the steam generator, judged on a basis of power for weight. It now remains for someone to make as big a reduction in boiler weights as Mr. Parsons has in engine weights. This will probably come in the direction of the rapid generation of steam in boilers of small capacity, of the kind used by Serpollet in his steam carriage, or that exhibited by De Laval at the Stockholm Exhibition, which is credited with carrying a pressure of 3,000 pounds to the square inch. The difficulty, of course, in the case of steam pressure running into the thousands would be the high temperature it would carry. A small and compact boiler capable of instantly generating 1,000 pound steam from small quantities of water supplied to it as required would be the logical counterpart of the turbine running at 2,000 revolutions per minute and expanding the steam to zero, which is what the Parsons triple expansion turbine now accomplishes.

WARNING TO INVENTORS.

As the new amendments to the patent law go into effect on January 1, 1898, it is well that inventors, both here and abroad, should bear in mind several of the very important changes which may seriously affect their rights.

1. Under the new law a patent cannot be obtained for any invention which has been patented or described in any printed publication in this or any other country more than two years prior to the application.

2. No patent shall be refused nor shall any patent be declared invalid by reason of its first having been patented in a foreign country, unless the said application was filed more than seven months prior to the application in this country.

3. The application must be completed and prepared for examination within one year after the filing of said application. In default thereof it shall be regarded as abandoned.

4. An interference will not be declared between an original application and a patent issued more than two years prior to the date of filing the said application.

In view of these changes in our patent practice, it is desirable that those who are interested and who will be affected by the laws as above mentioned should file their United States applications before January 1.

We have a number of times called attention to these impending changes, but they are of such great importance, particularly those mentioned in paragraphs 1 and 2, that we take this occasion to again call attention to these points.

It should at the same time be borne in mind that the term of the United States patent will not be shortened by the prior filing or issuing of a foreign patent for the same invention. It is possible, therefore, for the American inventor now to proceed with foreign applications without waiting for his United States patent to be issued.

LIEUTENANT PEARY IN ENGLAND.

Lieut. Peary has arrived in England, and before he sailed he stated that after delivering a lecture before the Royal Geographical Society on December 6, and later before the Scottish Geographical Society at Edinburgh, he would go to Dundee, Peterhead and Aberdeen to look over the whaling fleets there and pick out a vessel from 300 to 500 tons register for his next expedition to the Arctic regions. We have already outlined Lieut. Peary's plan of campaign.

Speaking of the doubt that Nansen had thrown upon the genuineness of the meteorite which Mr. Peary recently brought from the Arctic region, the Lieutenant said: "Nansen spoke hastily on his arrival, but when he found he was wrong he frankly and courteously admitted his error. The impression has gone abroad that there is some feeling over the matter between Nansen and myself, but that is not true. I have the utmost admiration for Nansen and the magnificent work he has done." On the afternoon of December 8 Lieut. and Mrs. Peary paid a visit to the British Museum, where they were met by the Director Sir William Fowler and Curator Fletcher, of the Mineralogical Department. Mr. Fletcher examined a specimen of the Cape York meteorite discovered and brought to New York by Lieut. Peary, and unhesitatingly declared it was certainly of meteoric origin. He added that no specimen in the British Museum had meteoric characteristics more sharply or more clearly shown than those of the Cape York meteorite. The opinion of Mr. Fletcher, who is an expert, has so thoroughly convinced Dr. J. Scott Keltie, Secretary of the Royal Geographical Society, that it is considered by him to have settled the controversy as to the Cape York meteorite.

Mr. Peary complained in London of Captain Sverdrup's unfairness in going to Smith Sound next summer, but a dispatch from Christiania states that Capt. Sverdrup wrote to Mr. Peary some time ago that he did not aim to reach the Pole, but only intended to explore Greenland and to make a study of the ice. He imagines that Lieut. Peary cannot have received his letter.

ONE OF THE USEFUL APPLICATIONS OF THE STORAGE BATTERY.

BY WILLIAM BAXTER, JR.

When the storage battery first came prominently before the world, it was thought that its great field of usefulness would be that of the transportation of energy from coal fields and large water power sites to centers of industry. It was also believed that it would enable the electric motor to become a formidable rival of the steam locomotive, not only because it would reduce the cost of hauling a train, but because, in addition, it would remove many of the objectionable features of steam transit, such as smoke, cinders, etc. When put to the test it was found that the batteries, at least as then constructed, could not withstand the hard usage to which they were subjected in railroad work; and as to their value as transferrers of energy from the source of supply to the points of demand, it was found upon investigation that they could not compete with existing methods, even if made sufficiently substantial to endure constant usage with slight deterioration, and so perfect electrically as to have the greatest storage capacity, per unit of weight, consistent with theoretical possibilities. In this latter field they would necessarily fail, because, if made as light as possible, they would weigh at least twelve pounds for each horse power hour capacity, and as good steam engines can develop the same amount of energy from three or four pounds of coal, the weight of batteries to be transported back and forth would be three to four times that of the coal necessary to do the same work. The batteries then made weighed from one hundred and fifty to two hundred pounds per horse power hour capacity, instead of twelve; hence, the difference in weight to be transported under the actual conditions was so great as to render it impossible to accomplish anything practical in that field, even if the energy could be obtained free of cost.

When it was seen that the storage battery could not accomplish anything of a revolutionary character, those interested in its development began to study its adaptability to less pretentious work, and soon realized that it would be decidedly valuable as an adjunct to electric lighting stations, as it would be to these what the gasometer is to a gas distributing system—a reservoir from which the demand of customers could be supplied, should it become necessary at any time to stop the machinery for a few hours. Without the aid of storage batteries, if from any cause the operation of the generators is suspended, the lights will instantly go out and remain out until the generators are set in motion again. After years of persistent and very commendable experimental work, the inventors of storage batteries succeeded in making these devices sufficiently durable to withstand the wear and tear they are subjected to in station work, without unreasonable deterioration. Since that time they have been used to a considerable extent in that field, and within the last two years their use has been increasing at a very rapid rate; in fact, a first class station of to-day would not be considered complete without a storage battery plant.

The first battery plants installed in lighting stations were intended simply as a safeguard, to render it possible to keep up a supply of current in case of accident to the machinery; but it was not long before it was realized that by enlarging the capacity of the batteries, the output of the station could be greatly increased without materially increasing the expense of operation. How this result can be accomplished will be readily understood when it is considered that the demand for light is not uniform throughout the whole twenty-four hours, but varies from little or nothing, during the day and the early hours after midnight, up to the maximum amount between nine and ten in the evening. The station capacity, however, must be sufficient to meet the greatest demand; therefore, during the greater part of the time the machinery is only worked to a fraction of its full capacity. By using storage batteries, the generators can be worked to their full capacity all the time, and when the demand of consumers is small the surplus energy is stored, to be given out when the demand is in excess of the amount developed by the machinery.

From the very fact that the demand for current is variable, it becomes possible for batteries to be used not only to reduce the cost of production and increase the capacity of the station, but also to reduce the cost of line wires. This last result can be accomplished in any case where the station is located at some distance from the district in which the current is distributed. To illustrate this point, suppose the station is located say one mile from the center of the city or town in which the lights are used. If the current runs direct from the generators to the customers' lamps, the line wires must be of sufficient size to carry the maximum supply with a loss of pressure low enough to not interfere with the brilliancy of the light. If the maximum demand lasted for a considerable portion of the day, the full capacity of the line wire would be used to a reasonable extent, but the duration of this maximum demand is seldom over one-half, or, at the most, one hour; therefore, during the rest of the time a large portion of the line capacity may be regarded as wasted. The difference between the average and the greatest demand varies within wide limits, in different stations, but in the majority the ratio is not much below one to two. Whatever it may be, however, if the current could be supplied at the average rate, and the excess over the demand when the consumption is small were stored, the amount so stored could be used to supply the deficiency when the demand is large. This is accomplished in many cases at the present time by placing a storage battery plant at the center of the district in which the customers are located. The wires coming from the generating station are so connected with the battery and the distributing mains that, whenever the drain is less than the current coming from the station, the batteries are charged, and when the demand is in excess of the current from the station, the battery feeds into the distributing mains. The current passing from the generating station to the battery station is about ten per cent more than the average demand, so as to cover the loss in the charging and discharging of the batteries.

The saving in wire by this arrangement will run from about twenty-five to seventy-five per cent, depending upon the relation between the average and the maximum current, and also upon the amount of energy that is lost in transmitting the current from the generators to the battery. When the generating station feeds directly into the distributing mains, the loss of energy in transmission is governed by the condition that the pressure of the current must not drop so much as to interfere with the brilliancy of the lights, and therefore the line loss is generally low; but when batteries are used, located at the center of distribution, they regulate the pressure of the current supplied to the lamps; and, therefore, the loss between generator and battery may be made anything desired, without affecting the brilliancy of the lights. If the power is obtained from a waterfall or from coal near a railroad, when it can be obtained at a very low price, it may be more economical to increase the loss of energy between generator and battery, and thus reduce the cost of line wire, but such conditions cannot be taken advantage of if the battery is not used.

FURTHER RECORDS FOR THE KAISER WILHELM DER GROSSE.

The Kaiser Wilhelm der Grosse has added further records to those which she has already placed so rapidly to her credit. As already mentioned in previous issues, she has accomplished the longest all-day run by covering 564 knots within the twenty-four hours, and she now holds the record of an average hourly speed of 22·35 knots for the whole trip across the ocean. This is 0·34 knot faster than the best trip of the Campania. When she left New York on her last passage she passed the Sandy Hook Lightship 4:30 P. M. Six days later she passed the Needles at 3:10 P.M., the total distance covered being 3,065 knots, and the actual time five days, seventeen hours and eight minutes. This is equivalent to a railway speed of 25½ miles per hour; and when we remember that this speed was maintained uninterruptedly for a distance equivalent to 3,524 land miles, we realize that steamship travel is well up to the average performance of the overland trains of but a few years ago.

AN EXCELLENT HOLIDAY GIFT.

As the Christmas season approaches we desire to call the attention of our readers to the appropriateness of our new work, "Magic: Stage Illusions and Scientific Diversions, including Trick Photography," as a holiday gift. It is a large octavo volume of 568 pages, embellished with 420 illustrations, and is tastefully bound in imported cloth stamped with ink of three colors. The book appeals to all classes, and purchasers have the satisfaction of knowing that the profession have indorsed it as "the standard work on magic." The press notices have been quite exceptional. A number of interesting letters have been received from prominent magicians. Our readers hardly need to be informed of the quality of the illusions or the thorough manner in which the tricks are exposed, as excellent examples have been in the SCIENTIFIC AMERICAN since the publication of the book.

SINKING OF THE HAVANA GRAVING DOCK.

In our issue for October 16, 1897, we illustrated the new floating dock for the port of Havana, procured in England at great expense and transported to Cuba with great difficulty. On December 6 the dock began to sink slowly. It is now beneath the waters of the bay. The unexpected disappearance of the dock created great consternation in the navy department and in the palace of the captain-general. The floating dock went down slowly and majestically and no one appears to know what was the matter with it. It is thought by some that the Cuban insurgents did something to it which caused it to sink, but this seems hardly possible, as there was no difficulty in guarding the dock. It is fortunate it went down slowly; for, had it gone down suddenly, there would probably have been great loss of life. Over two hundred men are working to float the dock, but their efforts thus far have been unavailing.

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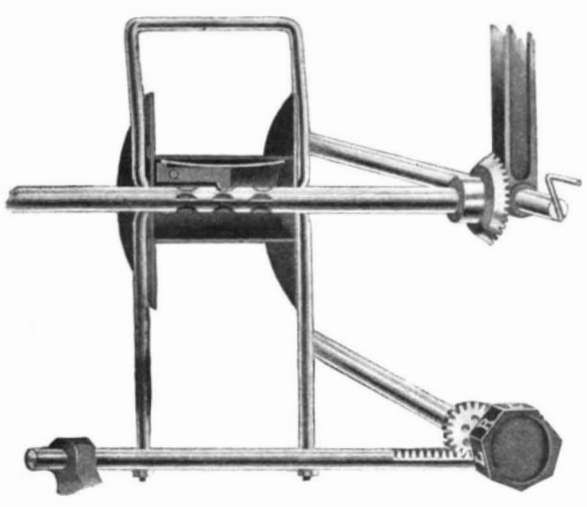
THE REM-SHO TYPEWRITER.

Our illustrations represent a typewriter which, besides its standard carriage, taking paper nine inches wide, is provided with a readily interchangeable carriage which will take paper fourteen and five-eighths inches wide, and which may be set to print on any ruled line. Other specially distinctive features of this machine are its shifting basket, the method of hanging

THE "REM-SHO" TYPEWRITER, AND SEPARATE LONG CARRIAGE.

and taking the shake out of the typebar, and the roller bearing carriage. The machine is manufactured by the Remington-Sholes Company, of 125 Rees Street, Chicago, of which C. N. Fay is president and F. Remington general manager. This firm has no connection with another well known typewriter manufacturing company, but its machine is the invention of Mr. Zalmon G. Sholes, who, as well as Mr. Remington, are sons of the original producers of the machine bearing the name of the latter.

The machine has the universal keyboard with a non-shifting carriage, the type basket only being shifted,



THE RIBBON MOVEMENT.

and, being firmly locked at each end of the shift when printing small letters or capitals, leaves both the paper carriage and keyboard undisturbed. The long carriage enables the machine to be used for work for which a second machine is ordinarily employed. The typebar is made of one piece of cold rolled steel, and the hanger, of the same material, has two independent sides, the bearing sockets being drilled, reamed, burnished and case-hardened, and the sides fitting accurately into slots in the basket frame, where they are held by lock screws. This prevents all possibility of the hangers turning and throwing their bars out of alignment, as when dependent for position entirely upon screws. To overcome the effect of wear, a taper-headed screw is located between the bearings, as shown in one of the views, a slight turn of the screw spreading the bar and taking up all looseness or shake. This spreader screw is not liable to work loose, owing to the long grip of the sleeve into which it fits.

The basket disk, carrying the typebars, connecting wires and ribs, is hung upon three ball bearings, allowing it to move freely backward and forward, without friction and without noise. It stands back normally to print lower case, and is shifted forward $\frac{80}{100}$ of an inch to print single capitals by pressing down on the "cap" button, returning automatically, while for a line of capitals a "cap" lock piece is pressed down. The platen or cylinder, with paper feed complete, can instantly be removed from the carriage frame, allowing the substitution of another without disturbing work in process of execution in the first. This permits the employment of extra platens specially ground to reduced diameter for heavy manifolding, which is of great importance in securing uniform alignment for such work. There is also a right hand rack release lever which permits the separation of the movement of line spacing and rack releasing, so that either movement can be made separately or both at once with the right hand alone.

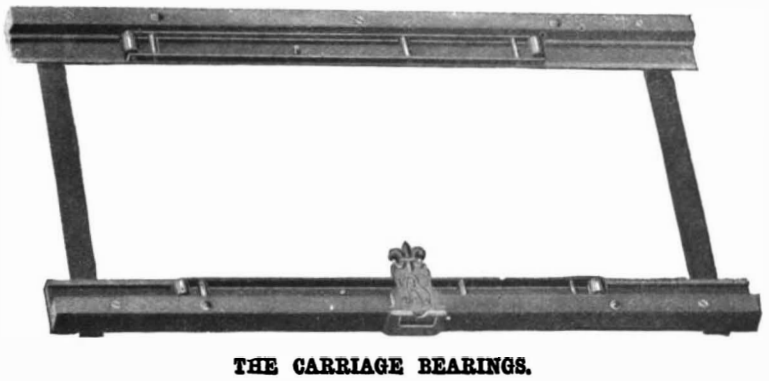
The ribbon movement is exceedingly simple, being of the older form, feeding with the grain and signaling for reverse, the ribbon being one and one-quarter inches wide and nine yards long. It feeds directly from one spool to the other, the ribbon being reversed by a slight touch to the octagon wheel shown in the cut, which both starts the ribbon winding in the opposite direction and moves it crosswise one-eighth of an inch, exposing a fresh printing path to the type until the entire face of the ribbon has been used. The octagon wheel, on whose sides the letters L and R are cut alternately, shows at a glance which way the ribbon is feeding. The spools are readily removable, and a winding crank winds the ribbon rapidly onto either spool.

In the carriage bearings, as will be seen from one of the views, rollers are used instead of wheels or balls, the rollers being three-eighths of an inch long and over one-quarter of an inch in diameter. It is said that no amount of wear seems to flatten or change the shape of these rollers, of which there are two on each rail, held at a fixed distance apart by a light truck frame. The carriage rests lightly upon them, and accidental tilting is prevented by an overhanging lip running the length of each rail, but not touching the carriage.

Type Bar and Hanger.

The paper feed is quite original, the pressure of the feed rolls when the platen is up being so light that the paper may be pulled as desired. There are three separate sets of feed rolls, upon none of which the pressure is unduly great, the front feed roll and paper fingers sliding with a mere touch easily to right or left, remaining where set, and feeding with equal ease and certainty wide or narrow sheets, envelopes, postal cards and carbons. The keyboard of the No. 2 "Rem-Sho" is the universal or standard, and contains 76 characters, while that of the No. 3 has 86 characters, and is particularly adapted to foreign use, or where special characters are required. One, two and three line spacing is provided for, and a reversible detent facilitates printing above or below the line.

The company make a machine with a special fine bronze finish, in which the frame casting is heavily plated with oxidized copper, the key levers, ribs, and connecting wires with red copper, the carriage rails and escapements also with copper, the small working parts nickel plated, and the scale black, with white graduation lines. The machine is designed to be one of the first in the market in beauty of design and richness of finish. The frame was designed by the late lamented Charles B. Atwood, designer of the Art building and Peristyle at the World's Fair at Chicago.

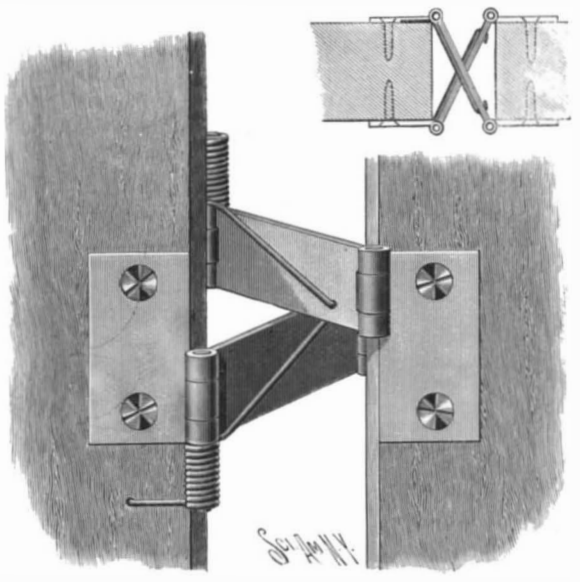


THE CARRIAGE BEARINGS.

ACCORDING to the most recent measurements, one kilogramme of water occupies 1000·101 cubic centimeters at 4° Centigrade.—Monatschrift für den Oeffentlichen Baudienst.

AN IMPROVED GATE HINGE.

The illustration represents a hinge of simple construction, designed to permit a gate to swing freely in either direction, but which will automatically return the gate to a normal central or closed position when the gate is released. The improvement has been patented by George H. Choate, of Hailey, Idaho. The large view represents, in perspective, the application of the hinge, the gate being in central position, the small figure being a plan view. On each side of the fence post is secured a plate to which is hinged an arm, the arms being one above the other, and coiled



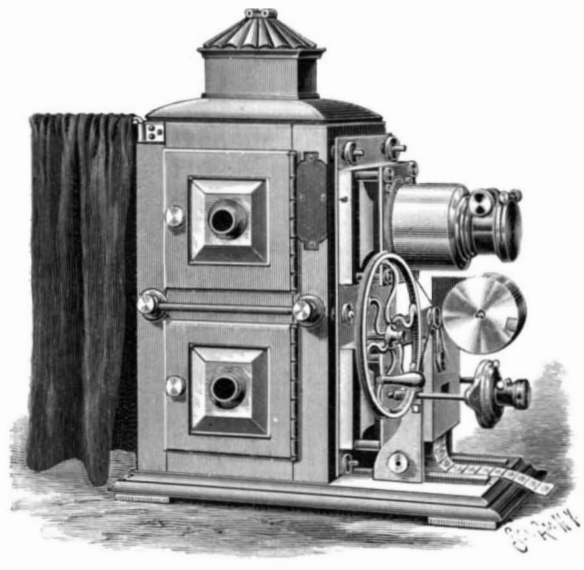
CHOATE'S GATE HINGE.

around each pintle of the hinges is a spring, one end of each spring engaging the fence post and the other end being provided with a hook which engages openings in the arms. The plates are crossed and hinged at their other ends to plates secured to side faces of the inner gate post, the disposition of the springs being such that they tend always to keep the parts in the normal central position shown.

AN APPARATUS FOR PROJECTING MOVING PICTURES.

The illustration represents an improved apparatus for projecting living and moving pictures, with which every movement of actual life may be depicted on the screen. It is being placed on the market by Messrs. Riley Brothers, optical lantern outfitters, of No. 16 Beekman Street, New York City. The apparatus is shown with a biunial lantern, which enables the operator to project the title of the picture from the upper lantern or show ordinary slides while another film is being introduced. He may also illustrate his lecture by ordinary lantern slides, and at suitable intervals project animated pictures from the lower slide, or he may use the lantern in an ordinary way, and in a few moments remove the bottom tubes and fix the kineoptoscope in position, and so close an entertainment with a demonstration of animated photos. The construction is such that vibration is reduced to a minimum, and the machine takes any standard films, which will pass through without tearing and quite uninjured. The machine may be fitted into the stage of any ordinary lantern which is open at the bottom, with a slight lengthening of the bolts. The lantern is furnished in a variety of styles, and the kineoptoscope accessories include the apparatus fixed on brackets and rails, with special short focus lens of high quality, fitted in an adjustable diaphragm, etc. The mechanism is so simple that the machine is not liable to get out of order.

MAYENCE has a special museum of Roman antiquities found on German soil. It embraces 14,760 objects, many of them of great value.



WRAY'S KINEOPTOSCOPE AND THE "MONARCH" BIUNIAL LANTERN.

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EXPERIMENTAL ACETYLENE GAS BUOY FOR NEW YORK HARBOR.

We have been favored by Lieut.-Col. D. P. Heap, Corps of Engineers, United States Army, with the particulars of an experimental acetylene gas buoy which he has designed for river and harbor service.

The new buoy, in addition to being more powerful and economical than the electrically lighted buoys, is more reliable. If one of a chain of the latter goes wrong, all the others are affected; whereas the acetylene buoy, being an independent and self-contained unit, will not affect any other buoys by its failure.

In order to save expense in carrying out the experiment, a first-class can buoy was pressed into service and modified for the test (see accompanying engravings). A cylinder, C C, of boiler iron, closed at the bottom, but open at the top, was attached to the diaphragm, D, of the buoy and firmly supported at the lower end. In this cylinder were placed and securely fastened three tanks, T T T, containing each about twenty pounds of liquefied acetylene gas under a pressure of six hundred pounds to the square inch. These three tanks are connected by piping to the regulator, R, which reduces the pressure to that of a two-inch water column.

From the regulator a pipe leads to a Naphey burner, so placed that the flame will be in the focus of a lens lantern provided with cut glass prisms, so as to concentrate the light in a horizontal plane. The candle power of the burner is twenty-five. This is increased by the lens lantern so that the emergent beam is about two hundred and thirty candle power.

One pound of liquefied acetylene will expand to fifteen cubic feet of gas; so the charge in this buoy equals nine hundred cubic feet. As the burner consumes a little less than one cubic foot per hour, the buoy should burn continuously for at least nine hundred hours.

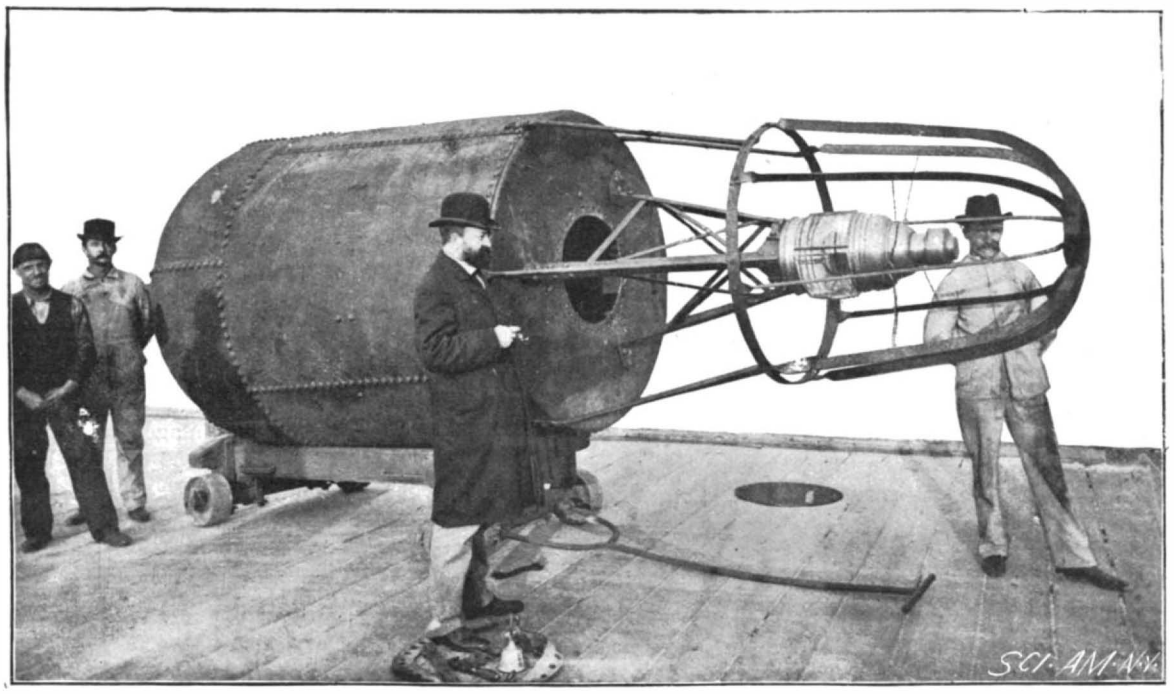
On October 30 the buoy was lighted and placed in the water near the north dock at the lighthouse depot. It burned continuously until November 10, when it was taken up and placed next day near Bay Ridge for convenience of examination by the Lighthouse Board. On the 12th it was replaced in its former position and continued to burn brilliantly until November 26, when the light began to grow less bright. The buoy was taken up, and an examination of the burner showed that carbon had deposited at the orifice. This was probably due to the burner being defective, as other burners of the same type had given far better results. The cost of the gas consumed in this trial was about one cent per hour, which is a remarkably low figure, especially in view of the brilliance of the light.

Experiments have also been carried out with liquefied acetylene gas for beacon lights, and it gives promise of equally good results in this direction.

The Lighthouse Board considers these tests so successful that additional and more severe experiments are to be made with an acetylene gas buoy moored near the entrance to Gedney's Channel and with an acetylene gas-lighted beacon on Romer Shoal. The same buoy will be used, such modifications being made as have been suggested by the Bay Ridge experiments.

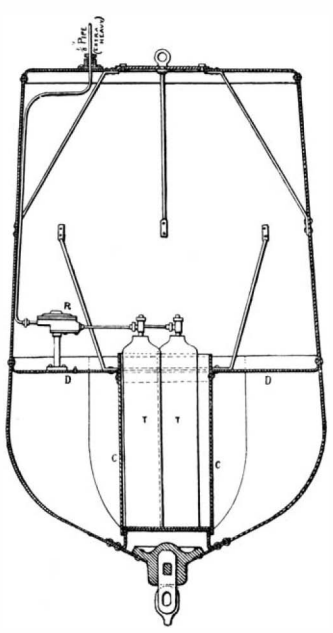
The two principal advantages which would obtain if this method of lighting proves after extended trial to be successful and practical are, first, large reduction in first cost of gas-lighted buoys and, second, large increase in the power of the light.

TROLLEY car ambulances are to be introduced in the city of Pittsburg, running independently over all the street car tracks as called for.

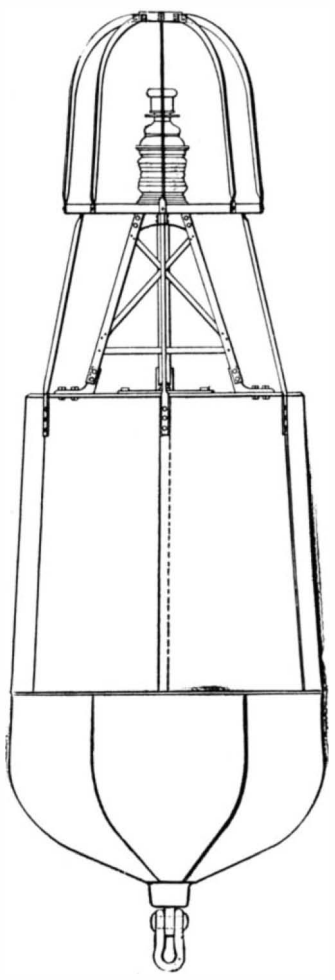


ACETYLENE GAS BUOY FOR NEW YORK HARBOR.

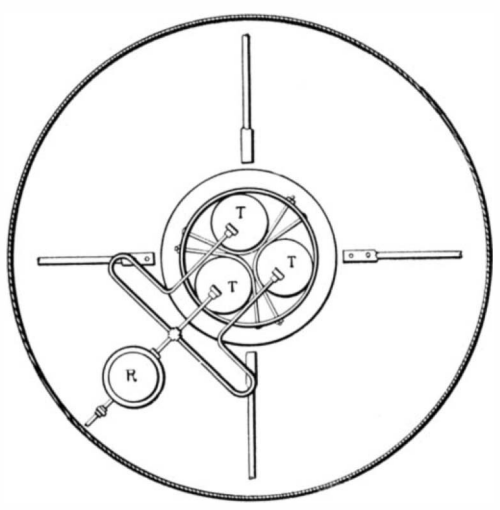
Light, 230 candle power; capacity, 900 hours; cost, one cent per hour.



SECTION THROUGH VERTICAL AXIS.



ELEVATION OF ACETYLENE GAS BUOY.



HORIZONTAL SECTION ABOVE TANKS.

The Gravehals Tunnel, Norway.

The Gravehals tunnel, on the Bergen Railway in Norway, is the longest tunnel on the North European continent, its length being about three miles sixteen hundred feet. Its cost will, however, be unusually low compared to most other tunnels, which are generally double-tracked and bricked to a considerable extent, while the Gravehals tunnel, according to the present arrangements, will not only be for a single line, but even for narrow gage, although it is hoped that the legislature will increase the vote so as to allow of the ordinary gage being adopted. With regard to brickwork, it is calculated that only about 3 per cent of its length will have to be lined. These circumstances bring about a great difference in cost in favor of the Norwegian tunnel, which will only cost some 500 kr. or £27 10s. per lineal meter, whereas the usual cost of similar tunnels elsewhere amounts from £100 to £110 per meter. Both the ends of the tunnel are at an elevation of some 2,900 feet above the level of the sea. The results arrived at as to the quality of the rock by the special committee appointed to investigate this matter have so far proved correct, and the rock has not been very difficult to handle. The work commenced at the west side, at Opsät, in October, 1895. The work was, through the whole of 1896, carried on by hand boring, the necessary preliminary investigations as to the employment of water power not having been completed.

In order to procure water for the turbines, it was necessary to construct a reservoir on the mountain itself, and fears were entertained that the water would be so cold that it would freeze before it reached the turbines, even if the pipes were well protected. These fears were, however, dispelled, as the water's temperature never fell below 0·5° C. at the spot intended for the installation of the turbines. The power from the turbines amounts to 220 effective horse power, there being two turbines of, respectively, 120 and 100 horse power. The two boring machines require 60 horse power. Some 30 to 40 horse power will be required for ventilating purposes, there being some two or three ventilators coupled, the one behind the other, so that the one delivers into the other.

Some 15 horse power will be wanted for the two electric locomotives, which are intended to replace the horses used at present for the purpose of removing the debris. There being a gradient of 2 to 5 in 1,000, the loaded wagons will almost run by themselves, the locomotives being really only wanted for the purpose of pulling back the empty trucks. The machine tools in the workshop are also worked by power from the turbines, transmitted by electricity. This takes some 15 horse power, and the dynamo for lighting purposes some 25 horse power. The smaller turbine, of 100 horse power, works the two hydraulic pumps for the boring machines. The surplus, of some 40 horse power, it is intended to use for two electric drills.

The whole installation, which has been in operation for some two or three months, works perfectly satisfactorily. The number of hands employed amounts to 125 men at the west side and 35 at the east side. Barracks have been built for the men at both places, with shops, dairy, laundry, bath house, etc. At Opsät, the average advance per day has been about 3 feet, making some 75 feet to 80 feet a month of 25 working days. About 2 pounds to 2½ pounds of dynamite have been used for every cubic meter of rock. This is by hand boring. By machine boring an advance of 7 feet to 8 feet has been made during 24 hours on the average, but the consumption of dynamite has been three or four times as large in proportion. According to the experience at Gravehals, machine boring does not come cheaper than hand boring. The tunnel has to be ready for rails by April 12, 1903, and there is every prospect of its being ready some time before then; according to the plan, about 14,000 feet will be done from the west end—1,000 feet by hand and 13,000 feet by machine—and some 3,600 feet from the east by hand.

Some trouble has been experienced with the men, who will not settle down, although they can save considerably; but they rarely stay more than six months. The average pay for all piecework is 4s. 2d. per day, in addition to which the men have free lodging, light and fuel. The drillers in the rock earn some 6s. to 10s. per day. Board costs 1s. 4d. per day less for those who keep house themselves. An experiment with some 20 Italian men proved entirely unsatisfactory, and they had to be sent back.—Engineering.

A New Map of the Yukon Region.

The Coast and Geodetic Survey have prepared and will soon publish a new map which will cover the entire length of the Yukon River and most of its tributaries including the Klondike region. The scale is twenty miles to the inch. The section embraced extends from the Selwyn River, several hundred miles above Dawson City, to the mouth of the Yukon and the section is wide enough to give a fair idea of the extent and character of all the streams. It shows the location and extent of the St. Michael Military Reservation and gives the location of all towns and mining camps.

AFTER forty-eight years the Arundel Society, established to reproduce in color and popularize the masterpieces of painting, has come to an end, the improved and cheapened methods of reproduction having made its work unnecessary. Isochromatic photography has been one of the most powerful factors in rendering work of this nature obsolete.

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Science Notes.

In investigating the properties of certain substances whose critical point had not been definitely ascertained, Messrs. A. Leduc and P. Sacerdote made use of an original method. They took the critical point to be that at which light ceases to be diffracted by the surface of any as yet unvolatilized liquid. By this method they were able to calculate their results to within 0·5° Centigrade and one atmosphere.—Revue Scientifique.

A number of Swiss lakes were recently sounded, the results being as below:

Lake Langensee	1,186 feet.
Lake of Geneva	1,007 "
Lake of Brienz	848 "
Lake of Lucerne	695 "
Zug Lake	643 "
Lake of Zurich	464 "

—Revue Scientifique.

London fog absorbs 11·1 per cent of the luminous rays from an ordinary gas flame, while 20·8 per cent of the light from an incandescent mantle are lost in it. This is of course due to the fact that the first mentioned light contains far more red rays than the other, and that fog permits the passage of red rays to the exclusion of the blue is evident from the deep red color which the sun assumes when seen through mist.—Cosmos.

In the light of the recent researches on the oxydases recently recorded before the Académie des Sciences and the influence of manganese on vital oxidation, it is interesting to find that Guérin states that this metal is universally present as an organic compound in the ligneous tissues of trees. If sawdust is treated with feebly alkaline water and the extract is acidulated with hydrochloric acid, a precipitate will be obtained which, when washed with acid water and burned, is found to contain no iron, but 0·4 per cent of manganese and 4·6 per cent of nitrogen.—Comptes Rendus.

A Parliamentary return shows that the total number of visitors to the British Museum in the year 1896 amounted to 581,906, the highest number reached since 1890. This increase is partly accounted for by the admission of visitors on Sunday afternoons since May 17, 30,136 persons having been thus admitted. On the other hand, the number of evening visitors has further diminished since 1895 to 29,769. The total number of visits of students to the reading room during the year was 191,363, being 3,600 less than that of 1895, which again was lower than that of 1894 by 8,000. This diminution of numbers may perhaps, in some degree, be accounted for by the growth of local libraries in the metropolis, which have satisfied the requirements of students who would otherwise have had recourse to the British Museum. The daily average was about 630. The number of visitors to the Natural History Museum during 1896 was 417,033 on week days and 36,923 on Sundays, making a total of 453,956, as compared with 446,737 (on week days only) in the year 1895. The average attendance for all open days, including Sundays, during the year was 1,316; that for week days only, 1,336, as compared with 1,436 in 1895.

An optical device for the intensification of photographic pictures is described by Lord Rayleigh in the Philosophical Magazine for September. Photographers often obtain negatives which are so thin that intensification by chemical processes is insufficient to bring out any effective contrast between the transparent and opaque parts. The method devised by Lord Rayleigh is purely a physical one, and it may be described as a means of using a weak negative twice over. It is well known that by placing a feeble transparency upon a sheet of white paper, the picture becomes clearly visible, even though nothing can be seen when the transparency is viewed by holding it up to the light. Through the transparent parts the paper is seen with but little loss of brilliancy, while the opaque parts act, as it were, twice over, once before the light reaches the paper and once again after reflection on its way to the eye. This is the principle of Lord Rayleigh's method. Instead of the paper, a flat polished reflector is used, the film side of the negative being placed in close contact with it. On the other side of the negative, and fairly close to it, is a condensing lens, which gives parallelism to the rays from the candle used as a source of illumination. The candle is placed just alongside of the copying lens. The light from it passes through the condensing lens, and falls as a parallel beam upon the negative. After reflection, the light again traverses the lens, and forms an image of the candle centered upon the photographic copying lens. An optically intensified positive is thus obtained, and by copying it in the same way in the camera a negative with more pronounced contrast than the original may be made. To obtain satisfactory results, the false light reflected by the optical surfaces employed must be eliminated. In the case of the condensing lens the difficulty is overcome by giving the lens a slight slope with reference to the face of the negative. The false light reflected from the glass face of the negative to be copied may be got rid of by fixing a wedge-shaped glass plate to the glass side of the negative by means of fluid turpentine.

The Treasures of a Scrap Pile.

A scrap pile, if properly exploited, is not without its latent treasures. The Industrial World calls attention to the fact of the Baltimore & Ohio Railroad erecting a pile driver from old cast away iron. It says:

"The particular scrap pile from which the pile driver was evolved was recently enriched by the addition of the remains of the old bridge over the Muskingum River at Zanesville, which was taken down and replaced by one of modern design. In this increment was seen the opportunity for building a much needed pile driver, and the order was accordingly issued. Not a single dollar's worth of new material was ordered, except the sills of the platform, which were particularly heavy, and the hoisting engine and boiler. The castings required were made from the cast iron columns of the old bridge, with the addition of enough pig iron to insure a good quality of metal. The trucks were a pair of second-hand ones formerly used under a low flat car, put in good condition. The platform was built after the style of a flat car heavily braced. It is 40 feet long over the end sills and is supported by ten longitudinal sills. The center and intermediate sills are 5 by 9 inches, and the side sills are composed of two double sills 6 by 12 inches, spaced about 1 inch apart and trussed, with 1 inch rods on 6 inch queen posts. The whole floor is well trussed with 1¼ inch rods on 12 inch queen posts, fastened to 8 inch tie timbers. Underneath is a capacious tool box. The body and truck bolsters are of the combination type, with six flitch plates ¾ inch thick, both bolsters being extended beyond the body for convenience in blocking and steadying the machine while at work. The hammer weighs 2,800 pounds and has a total fall of 38 feet. The superstructure is pivoted on a carriage that is made to travel the full length of the platform by power, so that the driver can be turned in a complete circle at any point on the platform by power from the engine. A cabin of substantial design frame with angle iron protects the engine and operator from the weather. The leads can be taken in and stowed in a longitudinal position for transportation by means of a jointed brace, using the hammer as a counterweight."

A New Developer—Diamidoresorcine.

This is a new developer derived from aromatic series and christened with an English name. Ortol is one to which MM. Lumiere and Leyewetz have already given considerable attention. The properties of this developer are essentially the same as those of amidol, but with some additional qualities. It can, like amidol, be put up in powdered form and be easily dissolved when wanted.

One of its advantages over amidol is that its action may be considerably retarded by bromide of potassium, which allows, to a certain extent, the correction of any errors due to over-exposure.

The following is the formula:

Water	100 grammes.
Anhydrous sulphite soda	3 "
Chlorhydrate diamidoresorcine	1 "

If the proportion of the diamidoresorcine is increased or diminished, the reducing power is lessened and the image lacks vigor in both cases.

By increasing the quantity of sodium sulphite the reducing or developing power is proportionately increased, 10 grammes of sodium sulphite being the limit, however. An excess of sulphite beyond the amount mentioned is liable to produce fog. The solution slowly changes; after eight days its reducing power is considerably weaker, but as has been previously mentioned, its rapid solubility permits the developer to be quickly prepared and thereby renders the keeping of a stock solution on hand unnecessary.—Paris Photographic Gazette.

A Word to Mail Subscribers.

At the end of every year a great many subscriptions to the various SCIENTIFIC AMERICAN publications expire.

The bills for 1898 for the SCIENTIFIC AMERICAN, the SCIENTIFIC AMERICAN SUPPLEMENT, and the BUILDING EDITION of the SCIENTIFIC AMERICAN are now being mailed to those whose subscriptions come to an end with the year. Responding promptly to the invitation to renew saves removing the name from our subscription books, and secures without interruption the reception of the paper by the subscriber.

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Recent Archæological News.

Basle, Switzerland, is celebrating the four hundredth anniversary of Hans Holbein's death by an exhibition of his paintings and drawings, to which other Swiss museums have contributed.

While making some repairs to Heidelberg Castle recently, some workmen came across a window the style of which revealed the fact that the castle was not begun in 1411, as heretofore believed, but two hundred years earlier. Certainly, to all appearances, it has always seemed to date from a much earlier period than the beginning of the fifteenth century.

The French school at Delphi has lately unearthed two slabs of limestone which bear an inscription which is of great interest, dating, as it does, from the fourth century before Christ. This inscription, which consists of about two hundred lines, gives the price of work for building operations in Greece at the period named, and from it we learn that an architect was paid at the rate of under $150 per annum. This is not a great sum, even if its purchasing power is multiplied, as it should be, by five or six.

Three important finds of manuscript from the lost cities of central Asia are reported by the Asiatic Society of Bengal. They were found in sand-buried tombs and other buildings in Chinese Turkestan, and were picked up by peasants and passed on to traders. They vary in age, and consist of bark, palm leaves, or very coarse paper, sometimes coated with gypsum, and often very flimsy. Dr. Hoernle, president of the society at Calcutta, after examining them, believes that they relate mainly to religious ceremonies.

Skias has been conducting excavations on the left bank of the Ilissus in the neighborhood of the Kallirrhoe. About one hundred steps from the spring he discovered the foundations of the celebrated "Ionic temple on the Ilissus," which was seen and drawn by Stuart and Revett in the last century. Thereafter the temple disappeared, and its destruction was so complete that the present ruins would scarcely be regarded as the foundations of a temple but for the drawings of Stuart and Revett, with which they correspond exactly. Dörpfeld regards this as the temple of Artemis Agrotera, which Pausanias mentions immediately after he had crossed the Ilissus, and before he turned toward the Stadium.

A considerable part of a lost play by Menander has just been published at Geneva under the title of "Le Laboureur de Menandre." Hitherto, with the exception of quotations enshrined in the works of other authors, the only authenticated specimen of Menander's work was a fragment of twenty verses that was discovered by Tischendorf. Now Jules Nicole has brought papyri from Cairo which prove to be a part of one of Menander's most celebrated plays. These papyri contain nearly a hundred verses containing the essence of the plot, enabling a reconstitution of the *dramatis personæ*, and also the best part of the comedy. The authorship is established by the occurrence of three passages that are quoted by ancient writers as being from the play in question.

A correspondent of the English Colliery Guardian writes that the site of the prehistoric Celtic lake village, near Glastonbury, has been further excavated since July last, under the superintendence of the discoverer, Mr. Arthur Bulleid. The sites of the dwellings are marked by mounds. One of these contained the greatest depth of clay yet found, no less than 9 feet, the accumulation of successive hearths which were found necessary as the weight of the clay gradually compressed the peat beneath. This mound contained 300 tons of clay, all of which must have been brought in their boats by the inhabitants from the neighboring hills. Under the mound was found the framework of a loom with brushwood and wattlework to form the foundation. Another mound was very rich in fragments of pottery and other evidences of the manufacture of hardware. A neatly cut iron file about 8 inches long was found. Parts of three broken millstones were unearthed, and in one mound a clay oven measuring 2 feet by 9 inches. One glass article only was brought to light this year, a blue glass bead with a wavy line of dark blue running round it.

Remarkable Speed of the Yacht "Ellide."

During her last trial run over a measured mile on the Hudson River, the 80-foot yacht "Ellide" made the remarkable speed of 37·89 miles an hour. This places her far ahead of any steam yacht, large or small, in the world. The fastest steamship of any kind afloat to-day is the "Turbinia," an experimental torpedo boat, propelled by the Parsons steam turbine, which has a record of 40·35 miles per hour. The "Ellide" is 80 feet long, 8 feet 4 inches beam and 3 feet 6 inches draught. She is of composite construction, with steel frames and scantlings and mahogany skin. The motive power is furnished by a quadruple expansion engine, with cylinders of 9, 13, 18 and 24 inches diameter and 10 inches stroke. The mile course over which the run was made was measured by the United States Coast Survey.

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Correspondence.

PROBLEMS OF THE PYRAMIDS.

To the Editor of the SCIENTIFIC AMERICAN:

Fig. 1 represents the earth's orbit, divided into 365·244 day parts, having the sun in the center.

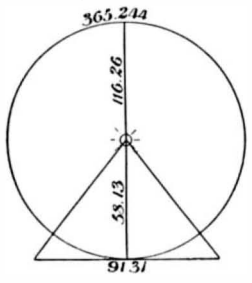

Fig. 1.

The diameter of the orbit is 116·26 day parts and the radius is 58·13 day parts. A right section of a pyramid is also shown whose height is the sun distance and whose base is equal 91·31 day parts. This pyramid is a type of the Great Pyramid of Egypt, whose height of 5,813 inches is evidently 100 inches to the day part. It is a π pyramid, and therefore the base is 100 inches to the day part, or 9,131 inches. It is stated by Pliny that the height of the Great Pyramid was 500 Roman feet. The Roman foot must have then been one-tenth of the earth's orbit in day parts, and called inches, 11·626 inches.

The base side length then was 785·4 of these feet and the circumference 3,141·6 of these feet.

The height of the pyramid was then intended to represent the sun distance; and by a late estimation it is one-billionth of that distance, which would be equal to 500,000,000,000 Roman feet. And if so, the circumference of the base would be one-billionth of the earth's orbit of 3,141,606,000,000 feet.

As to the coffer in the pyramid, according to the measures of Professor Greaves, the outside dimensions are equal to ten times the two foot cube, and the inside dimensions, within the measures of Professor Smyth, are equal to ten times the two foot sphere. Whether

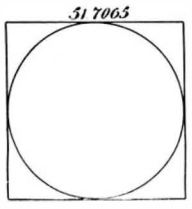

Fig. 2.

this was intentional or not, the measures which we call avoirdupois are derived from the one foot cube; and the troy and apothecaries' weights and measures are derived from the one foot sphere, the grain being 0·004 cubic inch of water, and 250 grains in the cubic inch of water.

The one foot sphere is peculiar. It is 3·1416 feet in circumference. It has a surface of 3·1416 square feet. It will contain the apothecaries' pint of 28·8 cubic inches 31·416 times.

It will contain 31·416 apothecaries' pounds of water or wine of 7,200 grains to the pound; and 31·416 troy pounds of wheat of 5,760 grains to the pound.

If there are eight pints in a gallon, it is equal to 230·4 cubic inches, which has been rounded off by legislation to 231.

The two foot sphere will contain 31·416 of these gallons and 314·16 pounds troy of water or wine.

This was probably the origin of the old wine barrel, which is now set down at thirty-one and a half gallons. Two of these barrels will make a hogshead of 62·832 gallons, now rounded off to 63. Four of these barrels will make a pipe or butt of 125·664 gallons, rounded off to 126. Eight of these barrels, or the four foot sphere, will make a tun of wine of 251·328 cubic inches, now rounded off to 252.

Ten of these barrels will make a chaldron. A tun of wine will just balance a chaldron of wheat. The outside content of the coffer by measure of Prof. Greaves will hold 6,000 pounds troy of 5,760 grains to pound; 5,000 avoirdupois pounds of 6,912 grains to the pound; and 4,800 pounds apothecary of 7,200 grains to the pound; also 600 troy gallons and 500 avoirdupois gallons of water. No measure but the one foot rule will produce these results, and it is the radius of the two foot sphere. W. F. QUINBY.

Wilmington, Del.

[Mr. Quinby's interesting letter adds a few more to the many striking coincidences, which have been pointed out by various writers, between the dimensions of the pyramids and the various measurements of time and space. Perhaps the most celebrated writer on this subject was Prof. Piazzi Smith, whose voluminous work was largely devoted to proving a relation to exist between the dimensions and order of the various stones in the great gallery and the history of the world. Although Prof. Smith, in common with many others, allowed his zeal to carry him beyond the bounds of probability and pointed out so-called analogies where only a prejudiced eye could see them, there are certain coincidences of the kind ingeniously worked out by our correspondent which are widely recognized. It is conceded, for instance, by many that the builders of the Great Pyramid seem to have intended that its height should bear to the perimeter of its base the same ratio as the diameter bears to the circumference of a circle. If this is true, all that our correspondent says about "day parts" would follow; and the question as to whether the Egyptians intended any reference to "day parts" becomes a matter of interesting conjecture.

The height of the Great Pyramid is variously given, the difference between the determinations being several feet. Our correspondent gives the height as 5,813 inches, or 484 feet. As the upper tiers of stones are gone and the exact angle of the slope is not determinable, the precise height of the pyramid is a matter of conjecture, though the height given agrees approximately with the generally accepted height. Upon the other point discussed in the note, viz., the relations of the sphere, whose diameter is one foot, to our numerous English measures of capacity and weight, his deductions are very curious. We have not verified them.

It cannot be implied in all or any of these comparisons that this was the manner in which our system of weights and measures came into existence; for, as a matter of fact, most of the units have been changed in value many times and have at the same time had different values among different nations. A perusal of the article on weights and measures in the Encyclopedia Britannica will convince one of this. The agreements above, so far as they are exact, are to be classed as coincidences, and where they fail in exactness is proof that no agreement was intended historically.—ED.]

The Theories Upon Which the Knapp Roller Boat was Built.

To the Editor of the SCIENTIFIC AMERICAN:

I am not a scientific man, but even an unscientific man of good ordinary intelligence can understand scientific matters when clearly explained, and, being untrammeled by any preconceived ideas, may be even better able to apprehend the principles of an entirely novel design than one technically trained.

It was doubtless just this freedom from the trammels of technical training which made Ericsson actually cross the Atlantic in a screw steam vessel while the scientists were figuring out proofs that it could not be done.

It is possible, then, that in spite of my frank confession, the following statements respecting Knapp's roller boat may be worthy of some attention, more especially as I have had the advantage of a close intimacy with the inventor, and frequent discussion with him during practically the whole time he has been inventing it.

Your article is one of the very few which have gone to the real point of the problem. The speed of the present type of vessel is limited by the amount of power required to force the hull forward against the resistance of the water, which in calm weather increases as the cube of the velocity.

When the water is set in motion by the wind in a contrary direction to the progress of the vessel, this resistance is enormously increased, and has perforce to be reduced by a corresponding reduction in the vessel's speed. Thus the Campania, which in calm weather can travel 560 miles in a day, is brought down to 180 miles in a strong head sea. I say a head sea rather than a head wind, because the weight of water meeting the 33 feet of submerged hull is obviously so much greater than the weight of wind meeting the upper works that it must be regarded as the chief element in the retardation of speed. It is, in fact, the only element needing serious consideration, the water being 700 times heavier than an equal bulk of air.

The effect of this resistance is, however, very different as regards ordinary vessels and the roller boat. The vessel of to-day is practically a water plow, forcing its way through the water, which, as long as no great speed is attempted, easily yields before it.

But as the speed of the boat increases, the resistance also increases in a vastly greater ratio, and consequently an enormous increase of horse power is necessary to increase the speed. How great this increase is is strikingly shown in a comparison of the Campania and Turbinia.

The Campania, making from 20 to 21 knots an hour, has 2½ horse power for every ton of her displacement. The Turbinia, making 32 knots, requires no less than 50 horse power per ton displaced. Nothing could more eloquently tell of the disproportion between the increased rate of speed and the increased resistance of the water.

The Bazin boat is but a modification of the plow principle. Her rollers are plow-shaped, i. e., they are disks, thin at the circumference and thick at the center. They do, indeed, roll, but they roll through and in the water, not upon it; and, although the proportion submerged is not so great as in an ordinary vessel, yet they are being forced through the water in the same way. They do, it is true, decrease somewhat the skin friction, and this, at low speeds, is a consideration. But, when high speed is reached, although skin friction exists and is increased by the speed, it is not the main obstacle to progress, but the water resistance, which cannot be overcome save by a greater increase of engine power than his boat is capable of carrying. And this is also true of all the roller boats planned or tried during the last half century.

The Knapp roller boat, however, is not a plow. Although a small portion of it is submerged, its mode of progression is essentially that of a broad-tired wheel rolling on the water. If it could rest on the water without any displacement, it would be a wheel or cylinder moving on a level surface. But, this being impossible, its partial submersion produces the effect of a wheel or cylinder rolling up a hill. What will be the effect of water resistance on such a mode of progression?

I think it must be admitted that, if the resistance were nil, the progress would be nil also. The paddles and skin of the boat would simply slip round and round, without going forward. But the more resistance can be increased, the faster the boat will go forward. It matters nothing how this resistance is gained, whether by paddles or by increased speed (utilizing the skin friction for all it is worth) or by the propulsion of the water toward the boat by the wind. For example, a cylinder or barrel will turn round and round in the water; but, placed on a solid, resisting body, it not only turns round, but moves forward. And the effect is the same, whether the power is applied from outside, as by hand or foot rolling the barrel, or from inside by gravitation, as by the squirrel revolving his cage, or from inside by leverage applied to the axle, as in the unicycle you described some months ago, or in Mr. Knapp's design for his boat. For the method of applying the power in the Toronto model is not his idea, nor has he ever approved it.

The increase of resistance to the ordinary vessel may be compared to a solidifying of the water in front of her. It becomes, so to speak, harder and harder to force the boat through, and at last a point is reached where she is no longer able to carry engines sufficiently powerful to overcome any more resistance. Of course the water is not actually hardened, but the effect is much as if it were; for, water being incompressible, it is also incapable of displacement at a high rate of speed.

With the Knapp boat, the more resistance is increased by her speed, the more easy becomes her forward movement, not through but on the water. Instead of reducing resistance by reduction of speed, the resistance will lift her out of her displacement, thus reducing resistance without reducing speed, and if sufficient speed can be obtained to increase resistance until it equals the weight of the boat, she must roll on the surface of the water without any displacement. At this point far less power would be necessary to keep her going than would be necessary previously to lift her out of her displacement and roll her up the hill. The real question to be solved, then, is: What power will be needed to start her and acquire the necessary speed?

Some idea as to this may be gained from the preliminary trials. Her engineers say that only about twelve horse power was developed at either attempt. Some of this was lost by the unfortunate slipping of the wheels on the track. Yet this small horse power was sufficient not only to revolve her about six or seven times in a minute, but also to send her forward at the rate of four to five miles per hour. This horse power is only about one-ninth horse power per ton displaced. It seems probable, therefore, that a comparatively small power will give her considerable speed, but this, of course, has yet to be tested. The slipping of the wheels, due to the moisture on the rails from the exhaust steam (a matter which the builders ought to have foreseen), will be guarded against during the winter, and next spring we may hope to see the real trial of her speed capability.

To sum up. The ordinary vessel is built on the finest possible lines to obtain the least point of resistance. The Knapp boat is built to go broadside on, to obtain the greatest possible contact with the water, and, consequently, the greatest resistance, because the resistance tends always to lift her out of her displacement and decrease the power necessary to acquire speed. This is the real point of the invention.

It is perhaps necessary to say that Mr. Knapp is not responsible for anything in this article, save when his own words are quoted. ROBERT W. RAYSON.

392 Alfred Street, Kingston, Ont.

[We publish the above letter as being, we believe, the first statement of the theories upon which the Knapp roller boat was built. We cannot agree with the writer that, if the boat could be driven fast enough to roll herself onto the surface of the water, the power necessary to propel her would be less than in a vessel of the normal type and the same displacement. If the normal draught of the Knapp boat is say 2 feet and her weight 200 tons, a certain proportion of the horse power of the boat must be expended in raising 200 tons 2 feet and maintaining it at that level. In the ordinary boat the weight is carried by the water, and the whole effort of the engines can be devoted to propulsion; but in the Knapp boat, as explained by our correspondent, the engines have not only to propel the boat but carry a part of its weight as well.—ED.]

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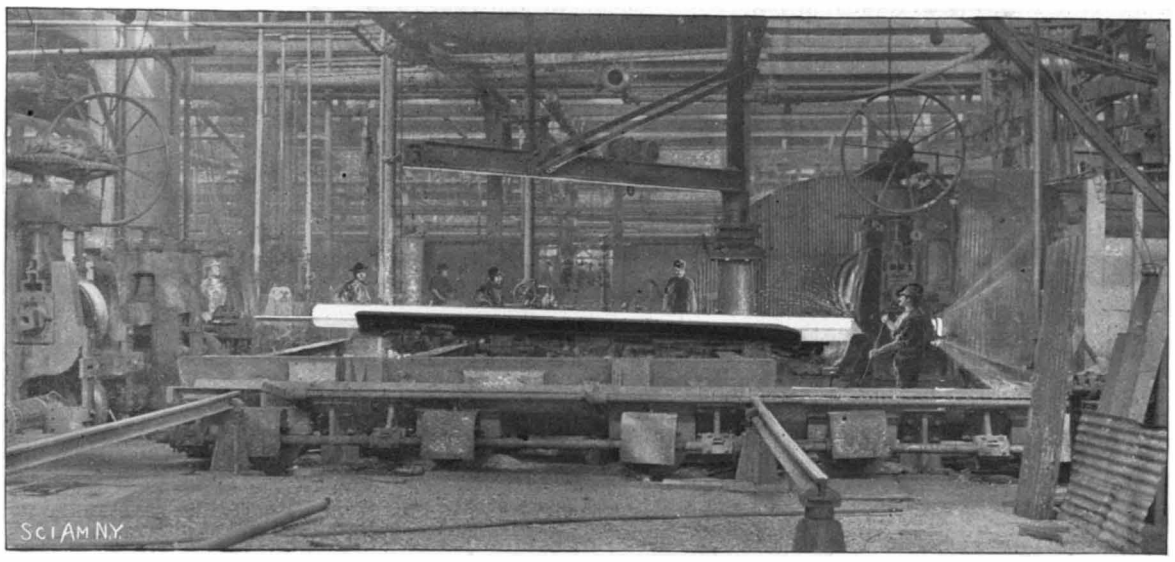
THE STEEL PIPE AND TUBE INDUSTRY.

III.—THE PIPE MILLS.

In our previous articles on the steel pipe and tube industry we have traced the manufacture of steel tubing through the blast furnace plant, where the iron ore is smelted and cast in the shape of pig iron, and through the steel plant, where the iron is converted into steel by decarburization with the air blast and rolled into long strips of various widths and thicknesses which are technically known as skelp. The third and final stage of manufacture occurs in the pipe department, where the skelp is rolled or drawn up into shape and welded into tubing.



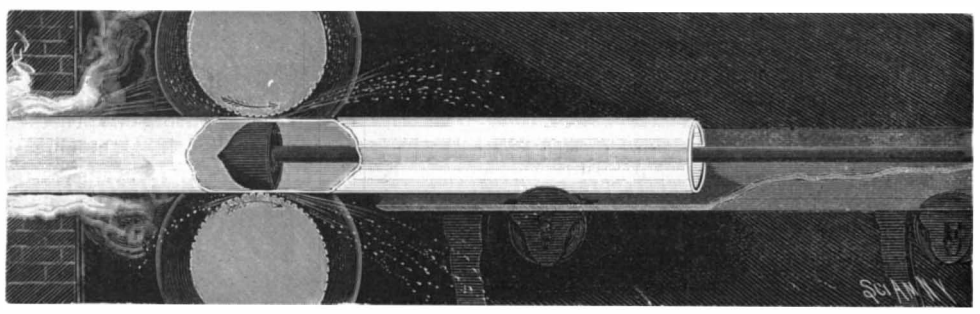
3.—LAP-WELDING A 16-INCH PIPE.

Perhaps the best idea of the scope and detail of this department is gained from the fact that from the diminutive ⅛ inch gas pipe up to the 24 and 36-inch water, oil or gas main there are more than 1,000 different sizes of tubing turned out of the pipe mills and listed on the books of the National Tube Works Company as carried regularly in stock. Broadly speaking, however, all the tubing may be divided into two classes —butt-welded and lap-welded—the former including all tubing from ⅛-inch up to 1¼-inch and the latter all sizes of pipe from 1½-inch up to 36-inch. The pipe mills in which the small gas and water pipe is made contain seven welding gas furnaces, together with the necessary cutting and threading machines and testing apparatus and a large stock house for the finished pipe, the whole being under one roof. The lap-weld mills, in which the larger sizes are made, contain ten double bending furnaces and twelve welding gas furnaces of the Siemens regenerative type. The pipe mill department also includes two large machine shops, a pipe coupling forge, a flange welding shop, a foundry and many departments of lesser importance. All of the furnaces are fired with an artificial gas known as "producer gas," which is manufactured on the premises by seventy-five producers.

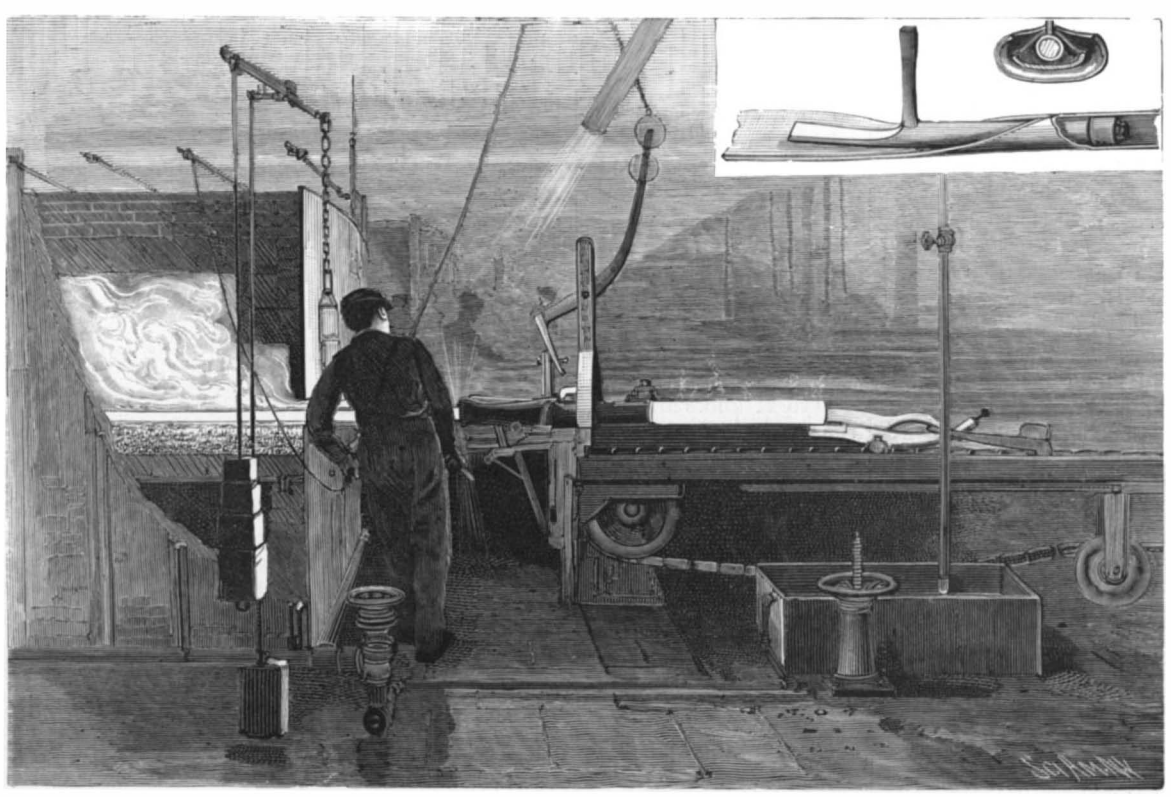
The previous article closed at a point where the steel had been rolled into long strips of the required size. Those intended for the larger sizes of pipe are fastened upon a traveling table where the edges are "scarfed" or beveled by the plate being drawn past a set of cutters. They are then pushed into a gas-fired "bending furnace," which, like all of the furnaces in this mill, is double ended, the material being introduced at one end and withdrawn at the other. As soon as the plate has been raised to a red heat, it is placed sidewise in the bending rolls. These consist of two lower rolls and a third vertically adjustable roll placed above and between them. The plate is rolled back and forth between the upper and lower rolls, the upper roll being gradually depressed until the plate is curved to shape with the scarfed edges overlapping. This method of forming up the pipe is adopted only for sizes from 8 inches up; the skelp for smaller sizes is formed by being drawn through a die, as shown in Fig. 5. The die is carried on a table at the level and just in front of the mouth of the furnace. It may be described as a stout iron tube, the front half of which, next the furnace, is split open and flattened out. Inside the die is a mandrel of the shape shown in the small sketch, Fig. 5, whose rear portion, lying within the closed end of the die, is of the size of the finished pipe. As the plate is pushed out of the furnace it is seized by a pair of heavy tongs and drawn through the die, the flaring sides of which gradually curve the plate until its edges meet and lap as it passes through the tubular end of the die.

The plates, scarfed and rolled or drawn up to shape, with their edges lapping, are now pushed into a gas-fired welding furnace, Fig. 1, by means of a steam "pusher." The pusher is controlled by the man who is shown seated between a pair of hand wheels, and the lengths of skelp are brought successively in front of the furnace by the workmen, and rolled into position from the table onto which it is delivered from the bending rolls. As soon as the skelp has been raised to a welding heat, a door at the back of the furnace is opened and it is pushed into the welding rolls, Figs. 3 and 4, which are located just outside the rear door of the furnace. The rolls are concave and are curved to the outside radius of the finished pipe, and between them, held in position by a long and stout bar, is a "ball" or mandrel of the same diameter as the inside of the pipe. As the skelp enters the rolls its lapping edges are squeezed together between the rolls and the mandrel and a perfect weld is made. The rolls are perforated with a number of countersunk holes to enable them to bite the skelp and insure its being driven forward over the mandrel. This produces the rivetlike projections which appear on welded pipe in the larger sizes. The reliable character of the welding is due to the perfect homogeneity of the steel (a result, as we have explained in the previous article, of exceptional care in the iron and steel process), together with the perfectly even welding heat which is secured in the gas furnace and the absence of the dirt and cinders which are unavoidable in welding furnaces heated by solid fuel. Moreover, as soon as it has passed through the welding rolls each piece is carefully examined, and all doubtful welds are rejected. The rough pipe is next passed through sizing rolls, in which it is brought to exact gage, and then through cross-straightening rolls, in which the axes of the two rolls are inclined at a considerable angle. It is then cooled on a movable table, where it is subjected to a cold blast of air and kept rolling to and fro. This prevents it from warping badly, as it would be apt to do if left to cool in one position, and relieves it of the strains which would be set up by uneven cooling. It is finally straightened in dies controlled by hydraulic pressure.

The pipe is then placed in a lathe where the rough ends are cut off. These ends are taken to the testing department, where they are put through various flanging, crushing and bending tests, as will be explained later in the present article. The pipe is now placed in the hydraulic testing machine, Fig. 8. This consists of a fixed and a movable head, the latter being shifted on the bed plate and keyed in a position corresponding approximately to the length of the pipe to be tested. The latter is supported between two face plates, in which are recessed a number of concentric annular grooves, corresponding to the various sizes of pipe. The grooves are filled with rope packing, and after it has been lifted into place the face plates are pressed firmly against the ends of the pipe by means of a hydraulic ram at one end of the machine (see Fig. 8). At the center of one face plate a nozzle leads from the hydraulic pump into the interior of the pipe. The smaller sizes are tested at 500 pounds to the square inch and the larger sizes at 1,000 pounds. Two inch line pipe is subjected to 1,500 pounds, and for oil well tubing the test runs as high as 2,500 pounds.



4.—LAP-WELDING ROLLS AND MANDREL.



5.—FORMING UP A 5-INCH PIPE.

Among the many branches into which the pipe mill department is subdivided, there is none that reflects greater credit than that in which the work of welding on the flanges is carried on. The interior of this shop is shown in the large front page engraving, where one end and the flange of a 22-inch pipe are shown being raised to a welding heat in a gas furnace. We have spoken of the screwed flanges which are fitted to the smaller sizes of pipe. Formerly this method and riveting were used for all sizes, and while the high quality of the steel enabled an excellent job to be done, the expansion and contraction of the screwed flanges, especially in the larger pipes, was apt to produce leaky joints in the course of time. The company, at the urgent request of one of their patrons, and after lengthy experiments, have succeeded in welding on the flanges and making the job as perfect as the lap weld in the pipe itself. The results in the medium sizes were so successful that the experiment was tried on pipes up to 30 inches in diameter, and with invariably excellent results. The flange is formed up out of a bar of steel. This is placed in a lathe, bored out and then faced on the inner face, care being taken to leave a ½-inch fillet on the inner edge. The end of the pipe is then swaged down slightly, say about ¼ inch, and the flange is pushed on over it, the edge of the pipe being beaded over with a few taps of the sledge hammer to keep the flange from coming off in the furnace. The latter, which is gas fired, is built in two semicircular halves, the upper of which is removable. It is built to the size of the pipe that is to be handled and is deep enough to permit a good body of flame to play around the flange and end of pipe. When the work has been raised to a welding heat, the pipe is swung round onto a concave anvil, which is stepped to receive both the pipe and the flange. The hammer is made L shaped, so that the horizontally projecting portion

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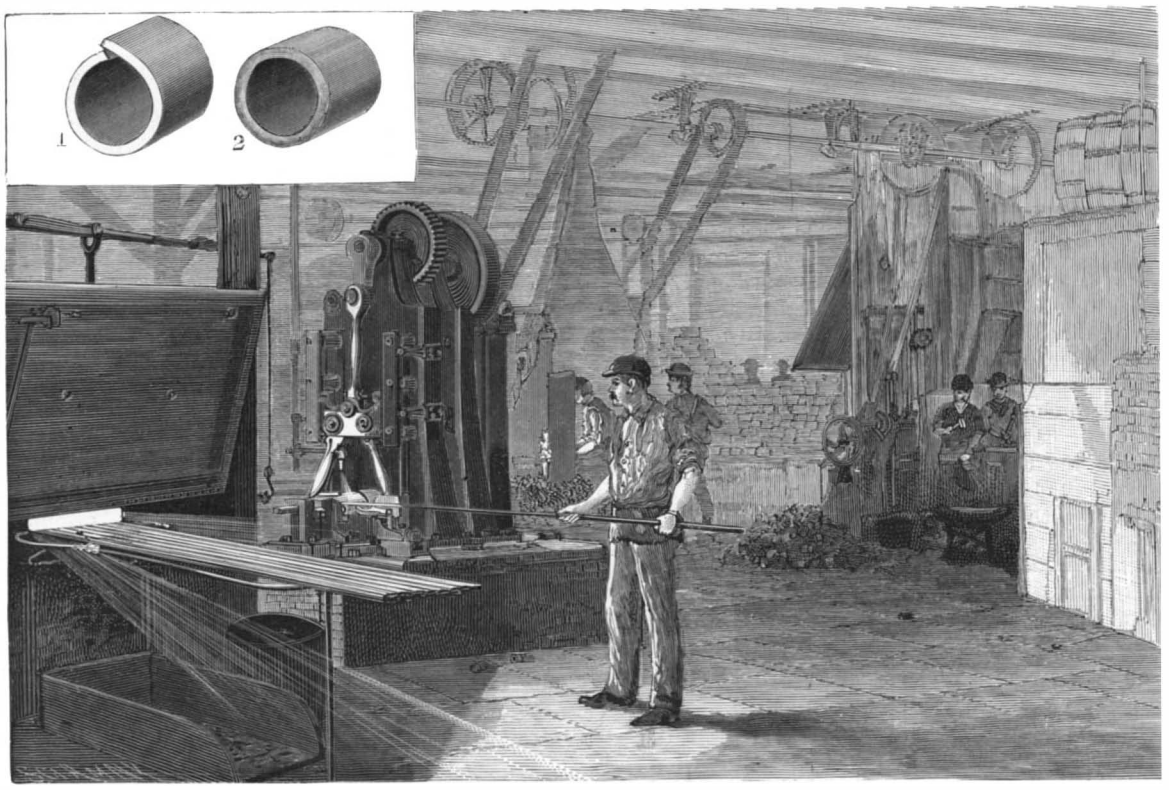
may enter and strike the interior surface of the pipe, and as the latter, with its flange, is turned round on the anvil the welding up is quickly completed. The operation is very speedy and the result thoroughly reliable and of course greatly superior to a screwed connection. Flanges have been welded on pipes up to 30 inches in diameter, and preparations are being made for flanging 36 inch pipes by the same method.

The manufacture of pipe couplings is shown in Figs. 6 and 7. They are made from bars of steel of the thickness and width of the coupling. The smaller sizes are made in a special machine (Fig. 6), which cuts off the desired length and forms it up on a mandrel with surprising rapidity. The pieces are then heated in a welding furnace and welded under the quick-acting steam hammer, shown in Fig. 7. The ends are then swaged down, the thread is tapped, and they are then ready to go on the pipes. As many as 40,000 couplings can be turned out in twenty-four hours.



6.—FORMING COUPLINGS.

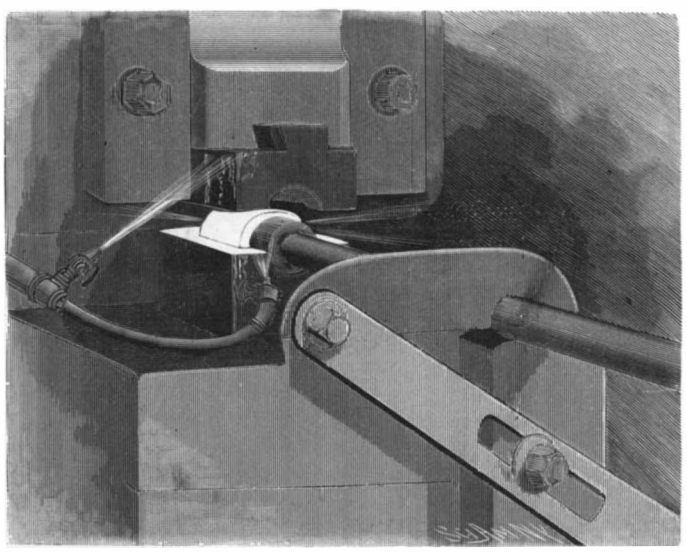
One corner of this huge department, which, by the way, employs 3,400 hands, is devoted to making bends. The pipe is first filled with sand to prevent its distortion, and it is then heated and forced by hydraulic pressure into a die of the desired radius. The result is so smooth and regular that these steel bends might easily be mistaken for cast iron pipe.

In addition to the standard pipe work, this department turns out a bewildering variety of special work, the mere enumeration of which would exceed the limits of this article. Among other special work we noticed working barrels for oil well pumps; steel trolley poles in which each length is swaged down and shrunk on over the end of the next smaller section; hydraulic pipe intended for a pressure of from 2,500 to 5,000 pounds to the square inch; Pintsch gas cylinders, made to stand a test of 600 pounds to the square inch; ammonia cylinders; compressed air hoists, and a lot of 16 inch pump columns for the great shaft, 4,000 feet deep, at the Homestake Mine. During our visit, the mills were employed on an order for 10,000 cylinders for the Liquid Carbonic Acid Gas Company, Chicago. The cylinders made for this company are numbered consecutively, the last of the present order being numbered 70,768. They are tested to 3,700 pounds to the square inch. The shells are 5 inches in diameter and have a concave flanged bottom welded in. The neck is swaged down and a solid steel plug is then welded into it, bored out and threaded.

We present illustrations of some typical tests that are daily being carried out at the works; for, in addition to the hydraulic tests already referred to, the tubing is continually being subjected to a variety of tests to determine the quality of the welds, etc. In cutting tubes to length, the rough ends are subjected to a longitudinal crushing load. If any tube fails at the weld, it is sent back to be rewelded. Other tubes are rolled with a Dudgeon expander and the ends beaded over, just as they would be if set in a boiler. Others again are subjected to side pressure, and in a comparative test of iron and steel tubes (Fig. 10) the former invariably cracked, while the steel showed no sign of fracture, even when the specimens were completely flattened out. The cold flanging test (Fig. 10) speaks for itself, the toughness of the steel showing up in marked contrast to the fibrous fracture of the wrought iron.

We have before us a report by Prof. Henry M. Howe, of Columbia College, of a series of tests undertaken this year to determine the relative merits of wrought iron and steel tubing. They were made on three classes of wrought iron and steel pipes: 2-inch line piping, 2-inch tubing, and 5⅝-inch casing. The iron pipes were obtained from three makers of good standing and the steel pipes from the National Tube Works.

1. Bursting Tests.—Hydraulic bursting tests were applied to fifty-one wrought iron pipes and thirty-six steel pipes, with the result that the steel pipes exceeded the bursting strength of the iron pipes on an average by 62 per cent, 41 per cent and 119 per cent, in the respective classes, and except in the case of three 2 inch line pipes, "the weakest steel pipe of each class was stronger than the strongest wrought iron pipe of that class." This is explained by the fact that the bursting strength of a pipe is limited by the strength of the metal across the grain, and that, while wrought iron is weak across the grain, steel is nearly as strong across as along the grain. Of the twenty-three steel pipes that burst at all, 17·4 per cent burst elsewhere than at the weld.

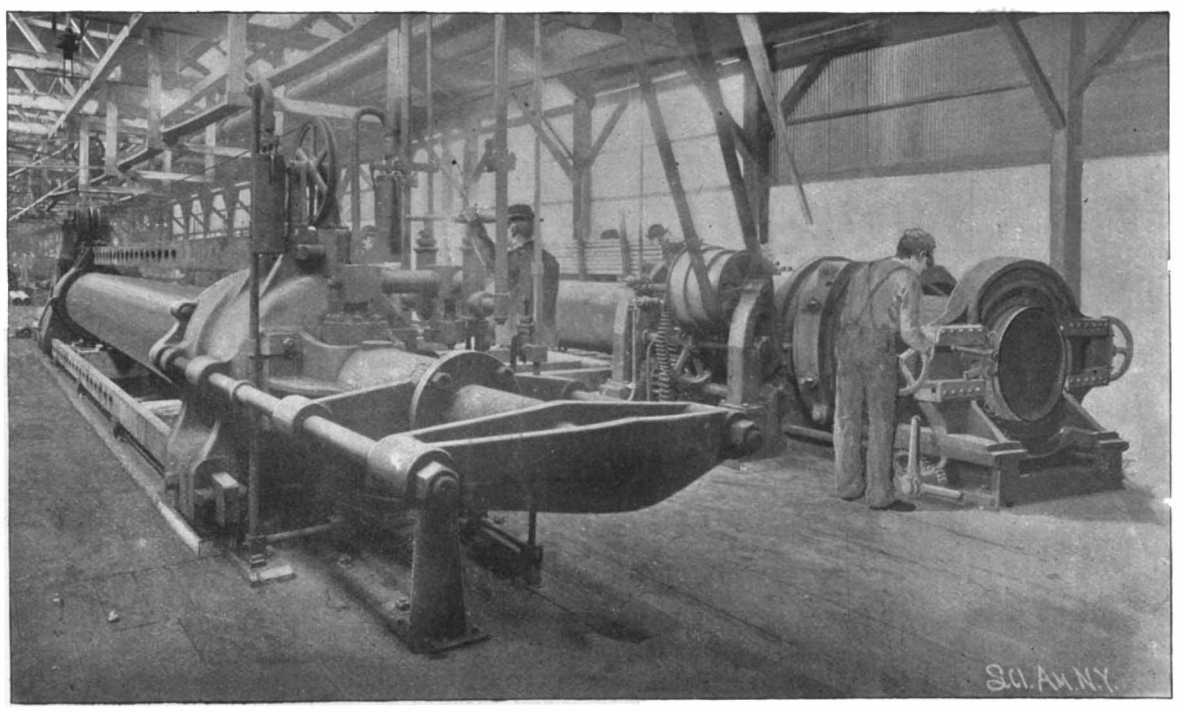


7.—WELDING COUPLINGS.

2. Tensile Tests.—In these eleven wrought iron and eleven steel pipes were tested, with the result that the steel exceeded the wrought iron on an average by 32 per cent, 22 per cent, and 52 per cent in the 2-inch line pipe, the 2-inch tubing, and the 5⅝-inch casing respectively.

3. Friction Tests.—The hydraulic test was applied to 104 feet of 2-inch wrought iron pipe and a similar length of 2-inch steel pipe. Water was run through at hydrant pressure and the loss of pressure noted. The steel showed a small but constant superiority to wrought iron, the pressure being about one-tenth pound per square inch greater at the discharge.

The conclusion of the third article closes our description of the steel tube industry as carried out in the establishment of the National Tube Works Company. In the vast scale on which the works are laid out, in the endless variety of labor-saving machinery employed, in the military precision with which the veritable army of employes is controlled, and in the exact scientific methods which govern every detail of the various processes, the reader has been introduced to an excellent example of that system of industrial economy which has won for us such a commanding position in the iron and steel industries of the world.



8.—HYDRAULIC PIPE TESTING MACHINE.

To Produce Photographs on Watch Cases.

A subscriber of the Keystone asks that journal for information as to the method of reproducing photographs on watch cases. The editor replies as follows:

There are several processes by which such transfers can be made, but there is really only one proper method for doing such work, and this is performed by a species of enameling, the details for the process of which, we think, have never been given in full. The following can be taken as the outlines of the process, and any workman accustomed to enameling can readily perfect the details. The cap is first prepared by giving it a coating of transparent frit, which gives the appearance of the cap being coated with transparent lacquer, and it is on this glassy coating that the picture is produced by what is known among photographers as the "dusting in" or "powder" process. In carrying out the details, proceed as follows: Take a good negative of the actual size of picture required. Next provide a piece of plate glass of suitable size, and after careful cleaning rub the surface with powdered talc, but leaving none of the dust on the plate. Now prepare a solution composed as follows: Select pure, clean bits of gum arabic to weigh sixty grains; glucose, forty-five grains; glycerine, ten minims; bichromate of potash, thirty grains; distilled water, two ounces. Mix, warm and filter through muslin. The plate glass has a film of this mixture flowed evenly upon it and dried in the dark. This surface is exposed under the negative above alluded to, for the proper length of time (to be ascertained by experiment); after which the coated glass (carefully preserved from the action of light) is taken into a cellar or some other place where the air is moist, under which conditions it absorb moisture proportionate to the action of the light. The portions screened from the light receive the most moisture, and consequent-

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ly are the best fitted to take and hold any dry powder brushed over the surface. The parts of the surface where the light has had full force do not hold any dust. The dust for the purpose under consideration is dial painter's black, a species of intensely black glass ground to an impalpable powder and now used dry. This powder is brushed over the face of the print with a soft camel's hair brush, and all particles, except such as are held by the tacky surface, carefully removed. The positive pictures by this process are very beautiful and perfect. To transfer to the watch cap, the picture on the glass has now a coating of tough collodion flowed over it and allowed to dry, after which the collodion film is separated from the glass and the coat of gum and dextrine washed away.

The positive picture is now placed on the watch cap (which was previously coated with transparent enamel) with the collodion side out. On heating the cap in a muffle, the collodion burns away and the black enamel pigment fuses and incorporates itself with the transparent glaze on the watch cap.

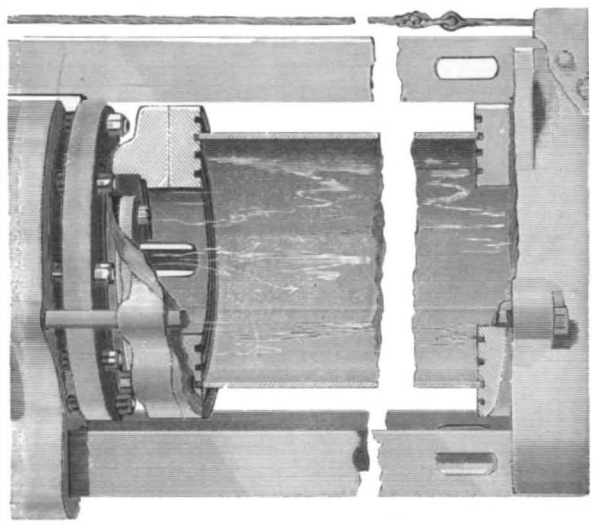
The St. Lawrence River Canal at Massena, N. Y.

Massena is situated in St. Lawrence County, New York State, on the Grasse River, which, nine miles below the village, empties into the St. Lawrence. The St. Lawrence River Canal will extend from a point on the St. Lawrence three miles northerly from Massena, having its intake just above the Long Sault Rapids, which have a fall of a little over fifty feet from the point of intake to the mouth of the Grasse River.

The canal, three miles in length, will be 225 feet wide and have an average depth of 25 feet, although in places cuts will reach 90 feet in depth. The canal will thus receive an almost level course, falling but 4 feet to the mile. At the mouth, where the water empties into the Grasse River, there is a fall of 47 feet. The volume of water will be much greater than is used at the Niagara power plant. The fall, however, is much less; therefore the turbines and generators will be differently arranged. A vertical shaft 140 feet in depth is used at Niagara; at Massena the turbines will be placed upon an inclined shaft. A ring of steel encircles each dynamo, the central revolving portion being the field magnets and not the armature, as in most other dynamos. The extreme diameter of the ring is 15 feet and the width 3 feet. This flywheel-like ring revolves within a stationary cylinder upon a surface made of thin soft steel set edgewise, which contains slots filled with copper bars parallel to the shaft, these bars being insulated with mica. The current will be delivered at 2,000 volts to the purchaser, and for long distance transmission it will be raised to 20,000 volts. The power house, the largest in the world, will be built upon a solid rock foundation. It will be about 600 feet long and 130 feet wide and 60 feet high; and will be provided with an electric traveling crane capable of lifting 85 tons. The generators, of which there will be 15, will weigh 350,000 pounds each and will make 180 revolutions per minute. They will be capable of developing 5,000 horse power each, or a total of 75,000 horse power. The total capacity of the canal is 150,000 horse power.

From the power house the circuits will extend to the factories to be constructed near by, one syndicate already having contracted for 35,000 horse power, for the purpose of manufacturing acetylene, this being made possible because of the limestone formation that underlies the whole section about Massena. Electricity converts this rock into calcium carbide, the basis of acetylene gas. Numerous other chemical compositions essential to the manufacture of gunpowder will be produced. Saltpeter will be refined and manufactured as in France and Germany. Other enterprises are contemplated, principally those which have in view the manufacture of certain chemicals which are now imported. The company already assert that they have contracted for all the power they can supply for some years to come.

The large operations upon the work of excavating the canal and the building of the power house attract hundreds of visitors to Massena almost daily, and that quiet little town, formerly in obscurity, except for its curative sulphur springs, has become in one brief month a thriving, bustling community. Midway along the canal, and at the point on the survey, has grown up what has been christened the "White City," the distributing point of the construction company. Here it will, for some distance, be necessary to excavate between 60 and 90 feet of earth. Over one hundred two-horse scrapers are at work. Two large graders, with eight mules in front and four behind, remove the surface dirt to a depth of fifteen inches, and roll it up from a plow-shaped blade into an endless belt, finally dumping it into wagons, a dozen or more being required to carry away the dirt from each grader. The graders are the most efficient excavating machines yet produced. They will excavate to within five feet of the water's level, and six, and later fifteen, big steam shovels then finish the work. These powerful machines, built much upon the plan of a harbor dredge, scoop the dirt out by means of cantilever cranes, carry it over the banks or upon dump cars, for a temporary railroad is being constructed the entire length of the canal. The soil is soft and sandy, with the exception of some very fine clay strata, and no serious engineering problems are encountered in the process of excavation. Occasionally a streak of quicksand is found, which causes temporary embarrassment, but otherwise the work is accomplished with very few difficulties. The number of steam shovels, graders, and the force of men, now numbering six hundred, will be increased as the work progresses, it being calculated that three



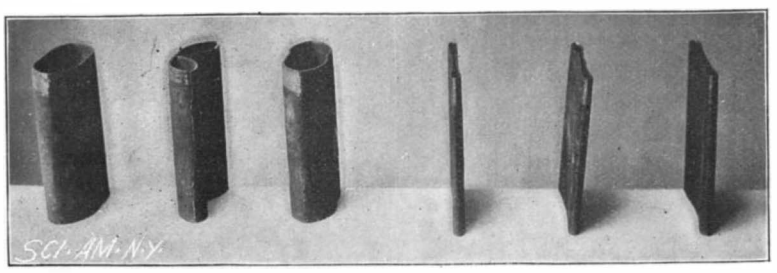
9.—DETAILS HYDRAULIC TESTING MACHINE.

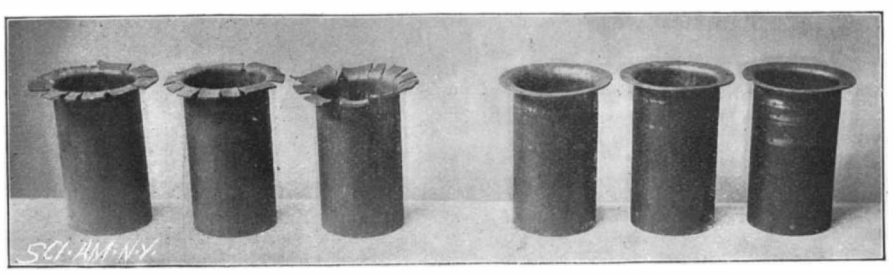
years will be required to complete the canal. The pay roll at present exceeds $15,000 per month.

The railroad facilities at Massena are favorable. The New York Central, by the R., W. & O. branch, and the Grand Trunk meet here. The navigation companies on the St. Lawrence are numerous, and this waterway will undoubtedly receive the greatest share of patronage when the works are finished. It is estimated that the volume of water emptied into the Grasse from the canal will raise that river by ten feet, thus making it a most favorable outlet for the products to be manufactured.

There is heard much talk that the projectors of the St. Lawrence Canal contemplate opening it for navigation purposes, thus making a water route on the American side that will compete with the Long Sault Canal, about nineteen miles long, which brings vessels below the Long Sault rapids. If this were done, it would shorten the canal route by nine miles and give vessels but three miles of canal to traverse under slow speed. Although this is a feasible enterprise, it is yet only a future possibility. Locks, which would be necessary under those circumstances, are not being constructed or provided for, and the navigation feature of the canal could only be realized after our government had dredged the Grasse River and opened it to navigation. It would undoubtedly be of great assistance to St. Lawrence River navigation, as well as a source of revenue to the owners of the canal; but whether it is thoroughly feasible to combine the two enterprises is problematical. The water for the Massena Canal comes entirely from the American side of the river and from this side of the Long Sault Island, therefore no international questions or complications can arise.

EDWIN WILDMAN.





10.—COMPARATIVE TESTS OF IRON AND STEEL TUBING.

THE STEEL PIPE AND TUBE INDUSTRY.

THIRTY KNOT TORPEDO BOAT CATCHER "BAILEY."

BY LIEUT. G. L. CARDEN.

The accompanying engravings represent the new torpedo boat catcher Bailey, so named by order of the navy department after the distinguished naval officer Theodoric Bailey, who was second in command to Farragut in the action of passing Forts Philip and Jackson on the Mississippi. The Bailey is one of three torpedo boat catchers for which provision was made at the last session of Congress. The sum appropriated for each boat was $250,000. In advertising for bids the navy department stipulated that a speed of 30 knots per hour would be exacted on the official course. The details of the design were left to the discretion of the builders.

The contract for the Bailey was awarded to Charles L. Seabury & Company and the Gas Engine and Power Company, of Morris Heights, New York. The work was obtained by this establishment at its bid of $210,000. The time in which the boat is to be finished is stated at eighteen months. A peculiar feature in connection with the contract is the fact, as stated above, that all designing work is left entirely to the builders. If the boat fails to do what is asked of her, the fault will be that of the contractors, and not of the navy department. In calling for bids, berthing space for forty officers and men and ability to carry the armament indicated, besides the 30 knots speed, were made conditions. Attention was called to the fact that all material used in hull and engines must conform to the navy department standards.

The Bailey is the first torpedo boat catcher ever built in the port of New York. The yards of the contractors are located on the Harlem River. When completed, as she will probably be, before the close of 1898, the Bailey will stand for the fastest craft possessed by the United States government. This statement is made on the expectation of the builders to attain a speed with the new boat of 33 knots per hour. Just what may be expected of the two sisters of the Bailey cannot at this time be conjectured. They have yet to be heard from. In making the great speed demanded of the new torpedo boat catchers there will be no opportunity for jockeying work. Specified weights must be carried, and on the occasion of the official trial run the boat must be in service trim. The designs which have been submitted to the navy department by the contractors, and approved, embrace the following principal features: Length, 205 feet; beam, 19 feet; depth of hold, 13 feet 5 inches; displacement on trial, 235 tons; and displacement when in commission, 265 tons. The trial weights must not be under the following figures: Hull, 67·5 tons; machinery, 115 tons; water, 10 tons; ordnance, 12·6 tons; coal, 20 tons; and equipments, 9 tons.

The armament will be a powerful one for a boat of this size. It will embrace four 6-pounder rapid-fire guns and three 18-inch torpedo discharge tubes. The latter are for Whitehead torpedoes.

The 6-pounder guns will be mounted two on the main deck, one on each side amidships, and two on platforms supported by the conning towers. The deck guns will have an arc of fire from sharp on the bow to right astern. The guns on top of the conning towers will have an almost all-around fire. The province of the torpedo boat catchers, or, as the British term them, "destroyers," is literally to destroy or capture torpedo boats proper. The average torpedo boat does not possess a speed much exceeding 22 to 23 knots. A torpedo boat like the Ariete of the Spanish navy, which is credited with a 26 knot showing on the measured mile, is an exceptionally high-powered craft. Even the Ariete could be easily overhauled by such a craft as the Bailey. Having run the little torpedo boat down, the catcher annihilates her with a heavy fire from her 6-pounder guns. The 6-pounder is a heavier piece than is given to torpedo boats. In consequence, the light 1-pounders which the latter usually carry are no match for the heavy guns of the pursuer. In the case of the Bailey this government has for the first time placed 6-pounder guns on its torpedo boat catchers. The Dupont and Porter, both torpedo boat catchers now in service, are armed each with four 1-pounder guns. The British practice is to equip their destroyers with one 12-pounder rapid-fire gun and three 6-pounders.

As in the case of all high speed vessels, there is no feature more interesting than the motive power. The Bailey will be supplied with engines capable of developing 5,600 horse power. This power is more than one-half the power employed on the Cunard steamer Umbria. The latter is a vessel of some 8,000 tons displacement, while the Bailey on trial will displace but 235 tons. The Bailey's engines are of the four cylinder triple-expansion type. The diameters in inches for the high, intermediate and low pressure cylinders respectively are 20, 30½ and 32. The com-

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mon stroke is 18 inches. The development of 5,600 horse power is expected when the engines are making about 400 revolutions per minute.

Steam will be furnished by four Seabury water tube boilers. Each boiler will be equipped with two furnaces. The working pressure will be 250 pounds to the square inch. As arranged, there will be two fire-rooms. Each boiler will have its own funnel, making four in all.

All steam pipes are to be constructed of steel, and all pipes leading into the bilge must be constructed of copper. The hull plates, frames and angle irons below the water line will be galvanized. The metal used in the construction of the "Bailey" will be so thin and light that no portion of it can be afforded to be wasted in rust. Although galvanizing is commonly understood to weaken metal, it is deemed safer to accept this initial reduction in strength than to trust to the uncertainties of water action and untreated plates.

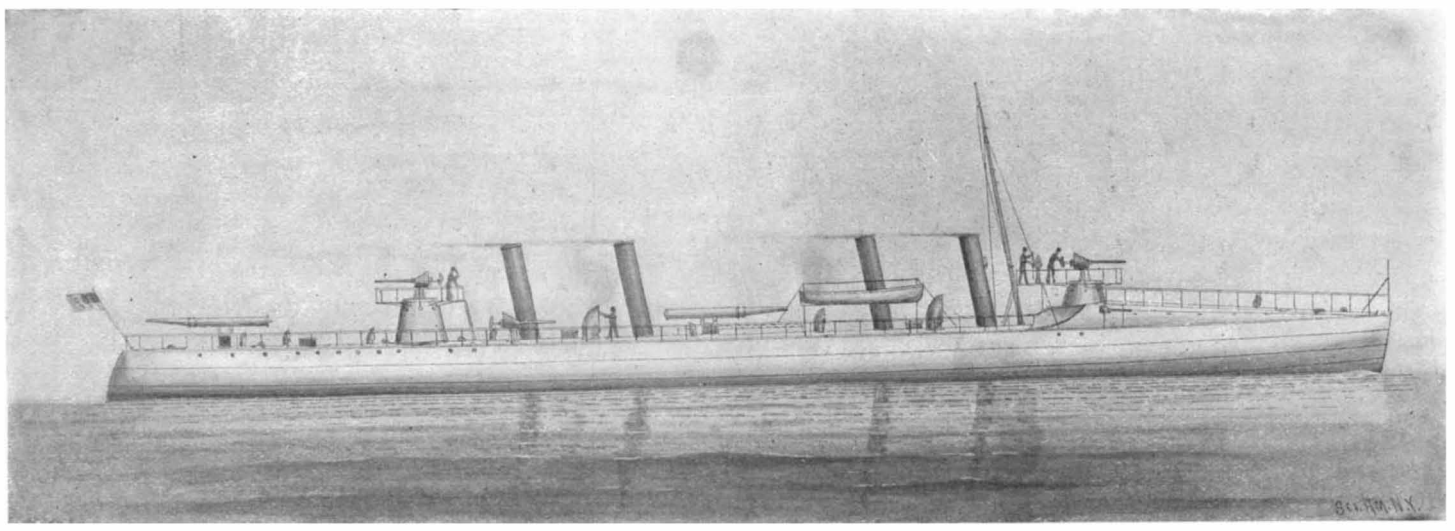
In the crew space forward there will be folding berths for thirty-three men. Of this number, eight will be for the machinists. The officers' bunks will be Pullman car berths, fitted into the sides of the boat, aft in the wardroom.

The Bailey, like the Dupont and Porter, will be able to do battle with battleships after the fashion of torpedo boats. When thus engaged she will have recourse to her torpedo tubes. But, as above shown, the principal duty of the new craft will be to drive off and annihilate with gun fire the torpedo boat torments of the battleships and cruisers. Speed alone will enable the Bailey to do this, and this speed the catcher is expected, by reason of her size, to maintain in a high sea.

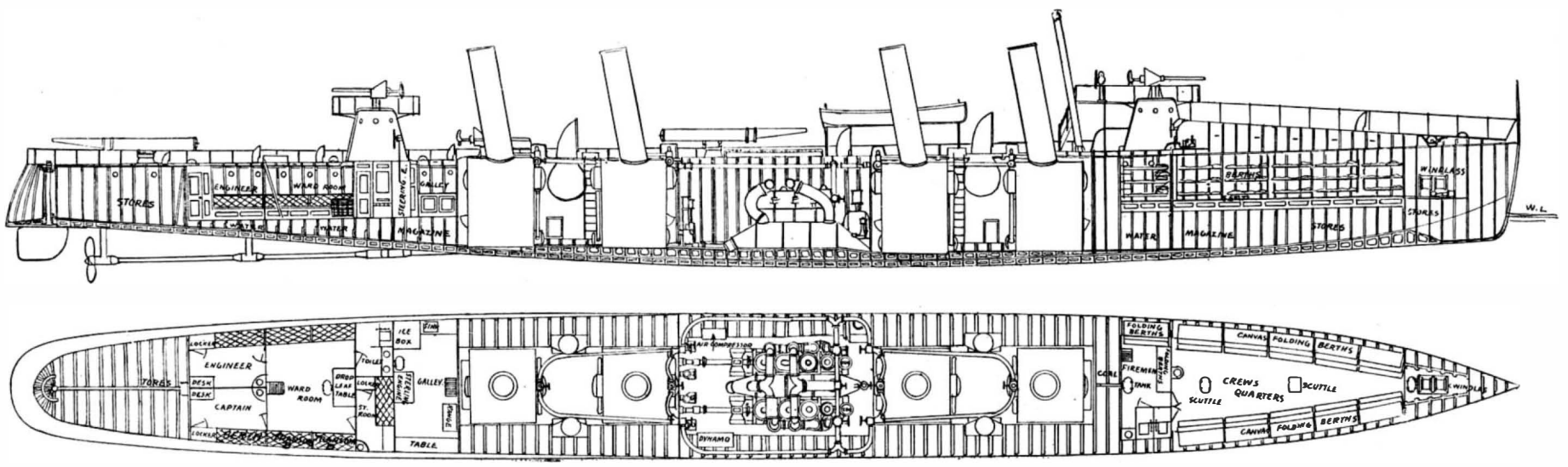
The Bailey is essentially a seagoing vessel. Her bunker capacity is deemed sufficient to enable her to steam three thousand knots at economical speed. In time of war she may be expected to accompany the battleship fleet, and to serve both as a scout and defense for the heavier vessels.

From the price to be paid for the Bailey, it will be seen that a torpedo boat catcher is an expensive craft. A torpedo boat possessing a speed of twenty-three knots per hour can, nowadays, be turned out for about $75,000.

The inspection work on the Bailey for the navy department is in the hands of Passed Assistant Engineer Carr, United States navy.



THIRTY KNOT TORPEDO BOAT CATCHER 'BAILEY," BUILDING AT NEW YORK FOR THE U. S. GOVERNMENT.



LONGITUDINAL SECTION AND PLAN OF THE "BAILEY."

RECENTLY PATENTED INVENTIONS.

Engineering.

ROTARY ENGINE. — Ward B. Story, Freehold, N. Y. Two patents have been granted this inventor for an engine in which abutments are mounted to swing on a cylinder, folding into recesses in the cylinder wall, and resting with their free ends against shoulders on the cylinder heads, a piston revolving in the cylinder having a fixed head extending in its working chamber, and the hub of the cylinder having inlet and exhaust ports. The arrangement is such that the steam is cut off during a part of the revolution to allow it to act expansively in the cylinder on the piston head, to which two impulses are given during every revolution of the main shaft. The piston may also have a plurality of piston heads, in connection with a series of movable abutments in the cylinder, a rotary valve connected with the supply and with an exhaust being adapted to connect with a series of ports leading into the cylinder, each port forming alternately an inlet and an exhaust port.

Railway Appliances.

RAILWAY SIGNAL.—John D. Taylor, Chillicothe, O. This invention relates to highway crossing signals provided with an electric bell which is automatically thrown into circuit by an approaching train and cut out of circuit by the train when it passes the crossing, the invention being designed to simplify such apparatus and reduce to a minimum the cost of construction and maintenance, while also lessening the liability to derangement.

Bicycles, Etc.

SADDLE. — David Basch, New York City. This saddle is made with a removable and interchangeable cushion at each side of its center, the cushions being held firmly in connection with the body of the saddle by a tie plate secured to the saddle body. The cushions are also provided with removable covers, held on by means of the tie plate, the cushions being light, durable and elastic, and resuming their original shape the moment they are relieved from pressure. All the parts of the saddle are readily and quickly dismantled and as readily assembled.

BICYCLE AIR PUMP.—Albert S. Noonan, Rome, N. Y. An air pump which may be conveniently operated by one hand is provided by this invention, the pump having the usual cylinder and piston, mounted on an outwardly extending stem to which is attached a handle, and the cylinder having a reduced outlet with which is connected a flexible tube, the other end of the tube being provided with a holder for attachment to the valve leading through the rim into the tire. The flexible tube allows the pump to be engaged with the valve nipple while the body portion of the pump is at a slight incline relatively to the wheel, the pump being held rigidly in place by the adjustable holder.

DEVICE FOR LOCKING BICYCLES. — Emil Buebel, of Altoona, and Jack Hall, of Juniata Kipple, Pa. This is a device for application to the front fork to prevent the wheel from being turned to the right or left, thereby preventing the unauthorized use of the machine. The lock is applied to the lower head tube fitting, adjacent to the crown of the forks, and the locking device proper and adjuncts are inclosed in a thin metal casing detachably secured to the fitting, the locking bolt sliding vertically, and its lower end when depressed entering a socket in the cone or fork crown bearing, thus locking the fork so that the front wheel cannot be turned to the right or left.

Mining, Etc.

PORTABLE GOLD WASHER. — Felix Kahn, Laredo, Texas. According to this improvement, two rotatable basins are mounted one above the other on a spindle or shaft held in suitable bearings in a small tank, means being provided for breaking up clods and stirring the pulverized ore as the basins rotate and also for discharging the liquid contents of the tank as required. The basin, spindle and connected parts are adapted to be easily removed from the water tank, and mercury may be placed in the basins to amalgamate the free gold. The device is particularly adapted for use by prospectors and in laboratory work.

AUTOMATIC DUMPING CAGE.—William K. Gordon, Thurber, Texas. For use in the shafts of coal mines, etc., this inventor has devised a platform so made and hung as to avoid pounding and racking of the guides and tower building, the platform turning on a true circle. Means are provided for automatically restoring the platform to a horizontal or carrying position after it has been dumped, locking the platform, and automatically unlocking it for dumping. The platform may be made to dump at either end, and provision is made to prevent the spilling of coal from the car into the shaft.

Mechanical.

ROUND BAR ROLLING MILL.—Paul J. Delay, Boucan, France. For making straight shafts or axles, and shafts of varying diameter, this mill is made with a series of rollers surrounding a central space adapted to receive the blank, slides carrying the rollers and being arranged to move radially in the frame of the machine, the rollers being carried bodily by the slides so that during the movement of the slides the axes of the rollers remain parallel to their original positions. Means are provided for moving the slides radially with the rollers, and for rotating the rollers while they are being moved inward against the blank. A hollow blank may be worked by inserting in it a mandrel, and blanks of original polygonal cross section may be worked in the mill.

SHAFTING COLLAR. — Heinrich Meltzer, Ratibor, Germany. An abutment ring or collar for shafting, to diminish the friction between bearings or loose pulleys, is provided by this invention, the collar having an exterior groove at one end forming a neck in which is a channel ring in which are located anti-friction balls. The channel ring bearing against a loose pulley permits the latter to turn independently of the shaft and at the same time holds the pulley from sliding on the shaft.

PATCHING SAWS.—Michael D. Ahearn, Green Bay, Wis. For cutting or grinding a concave recess in the side of a metal plate for the purpose of patching fractures in saws by brazing across such places cross sections, this inventor has devised a machine comprising horizontal guide rods on which slides a non-rotary frame, an oscillating frame being arranged within the non-rotary frame and carrying a horizontal shaft with drive pulley and cutting wheel, there being means for vertically adjusting this shaft and wheel.

SANDPAPERING MACHINE.—George C. Bonniwell, Hickory, N. C. A machine more especially designed for sandpapering the edges of door panels, etc., is provided by this invention, the machine having abrading disks with oppositely arranged abrading faces, and permitting of readily fastening the paper to the disks. The invention provides for a disk with inner and outer beveled edges, and clamping devices for holding a sheet of sandpaper on the edges, the disks being free to yield according to any unevenness in the work, to insure a proper and smooth sandpapering of opposite faces.

MECHANICAL MOVEMENT. — Sumpter L. Harwood, Uniontown, Ala. To transform reciprocating into rotary movement, and vice versa, this invention provides a shaft divided into two sections, each section being spirally grooved, but in opposite directions, a collar engaging each of the sections, and means being provided for moving one relatively to the other, and at the same time preventing the rotation of the collars except in one direction. The device possesses the advantage of having no dead center, and the stroke of the reciprocating member may be varied without affecting the rotation of the shaft.

NUT LOCK. — Townson Hand, North Vernon, Ind. According to this invention, any attempt to unscrew a nut on which this lock is employed will cause a cam member of the lock to rotate and bind firmly against the nut. The device comprises a fixed member having an inclined surface concentric with the bolt opening, and upon which rests the inclined inner surface of an annular locking cam, adapted to rotate and ride up the incline on the fixed member, and wedge firmly against the inner face of the nut, whenever the nut is turned in a direction to unscrew it.

PAPER WINDING MACHINE.—William H. Decker, Rumford Falls, Me. A machine more especially designed for use with machines for making wide paper has been designed by this inventor, the machine being arranged to relieve the winding shaft of its load, to prevent the shaft from springing, and, consequently, prevent irregular winding. Sliding bearings are provided for the shaft on which the paper is wound, and a supporting drum adapted to support the paper on the shaft is journaled in bearings fitted to slide at an angle to the line of movement of the shaft. The device is simple and durable and entirely automatic in its operation.

EDGE SETTING MACHINE.—Adam H. Prenzel, Reading, Pa. For setting and polishing the edges of the soles of boots and shoes, this improved machine affords a novel construction, arrangement and adjustment of the reversible head carrying the setting and polishing tools. The arrangement is such that two tools may be alternately brought into use or thrown out in a very convenient and practical manner;

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and, if desired, a hand rest may be employed below the shoe to hold it steady in turning the tool, a lamp or gas flame being placed adjacent to the tool not in use for alternately heating the tools.

Agricultural.

ANIMAL CLEANING DEVICE. — Orson P. Fretwell, Cedar City, Utah. This device comprises a rotary brush mounted in a framework in which is also mounted a gear wheel and connections, with a rubber or similarly covered tire on one or more operating wheels, the rotary brush being operated by pushing the device along in contact with the animal's body. Different forms of brushes and cleaners may be used, to be operated by the gear connections, for doing rapid and effective work in cleaning horses and other animals.

CANE PLANTER.—Jacob C. D'Azevedo, Brooklyn, N. Y. This invention relates to machines in which the operations of making a furrow, planting the cane, and covering the furrow are accomplished in successive and closely following steps, the machine facilitating the planting of cane of any desired length, planting the cane in multiple in the same furrow, and dropping the various pieces simultaneously. When the ground is covered with pea or other vines, the machine provides means for cutting the vines in advance of the plow, so that they will not interfere with the planting, and the machine is also provided with a marker not liable to be rendered inoperative by contact with an obstruction.

CONNECTING ROD FOR REAPERS, MOWERS, ETC.—Daniel J. Crosby, Kadina, South Australia. This rod is designed to facilitate actuating the knives of reapers and mowers, etc., in such a manner that, when obstructions are met with, the connecting rod, which converts the rotary into reciprocal motion, shall lengthen or shorten, and thus avoid breaking of the knife or other part of the machine. The rod has a spindle longitudinally movable through two bearings of a frame, a spring being located between the bearings, while two pins slidable in the spindle confine the spring, the pins being capable of engaging the bearings as the spindle reciprocates in the frame

BAND CUTTER AND SELF-FEEDER.—Henry J. Fourtner, Hazelton, Iowa. This machine is separate and distinct from a thrashing machine, with which it is connected only when it is desired to automatically feed the grain to the feeder of the thrasher. It is a simple and durable machine, readily applied to any thrashing machine and arranged to feed the grain in regular quantities corresponding to the capacity of the thrasher, to prevent over-feeding and consequent inferior thrashing. The operator, by throwing off the driving belt, may stop the band cutter and self-feeder at any time, to feed the grain by hand.

Miscellaneous.

PHOTOGRAPHIC CAMERA.—Daniel P. O'Leary and Samuel B. Kull, New York City. This invention covers an improvement upon a formerly patented invention of the same inventors, in which the movement of the film is automatically controlled by a shutter mechanism. The camera has a partition forming a guide for the portion of the film to be exposed, a casing for the film at the rear of the partition, a guide board secured to the rear of the partition near one side, the rear face of the guide board at the top and bottom being formed with recesses, while an index roller has its ends provided with toothed wheels adapted to engage the film at the recesses.

TRANSFERRING DESIGNS.—William R. Fish, Brooklyn, N. Y. To facilitate taking prints from lithographic stones or metal, etc., and converting them into sensitive transfer sheets, regardless of the age of the print or the number of times it has been used, this invention provides for first treating the sheet or film containing the drawing or design with a mixture of water and albumen, gelatine or one of the mucilaginous gums, then washing in water, then treating it with a greasy or printing ink, and then transferring to a stone, plate or printing surface.

GAS GENERATING MACHINE.—Frank A. Hutter, New Haven, Conn. This machine is designed to make gas for illuminating or heating purposes, and has a cylindrical generator, with perforated partitions, and packed with an absorbent material, the generator being mounted to be partially rotated occasionally, to facilitate the complete combustion of heavy oil An uninterrupted flow of air is secured by means of two pumps with flexible plungers, the air being forced from an air pressure cylinder through the generator, from which the gas formed is forced out through service pipes, and the motor being automatically stopped or retarded when the air pressure becomes too great, there being no danger of bursting.

SPRAYER. — Jules Bengue, Paris, France. This invention relates to devices for spraying ethyl chloride and other volatile liquids, employing therefor a capillary discharge opening with a protecting filter, but instead of the ordinary closing valve having a movable plug, a washer is used of suitable soft material, inclosed in a metallic cap. The washer is pressed against the orifice of the capillary opening by a spring and intermediary mechanism, such as levers, the apparatus being readily manipulated, while it may be tightly closed.

MOVEMENT OF FLUID IN PIPES, ETC.—Orville Carpenter, Pawtucket, R. I. This invention relates to fire sprinklers and other apparatus containing a fluid normally dormant, but adapted to flow when a valve or other device is opened, and to apparatus containing a fluid normally in motion and liable to have its flow interrupted. A new and improved method and means are provided by the invention for indicating the movement and cessation of movement of a fluid in a pipe, boiler or other apparatus, whereby an alarm is automatically given when the fluid is flowing or its movement ceases.

RESERVOIR PEN.—Carl J. Renz, New York City. This pen has a tapering tubular shank open at its inner end and provided with barriers, and an integral tongue extending beyond an opening at the branching of the nibs, it being designed to so construct an ordinary writing pen that, at one dipping of ink, it will take up and retain sufficient of the fluid to accomplish the writing of one or more letters of medium length without the necessity of a second supply. The pen, therefore, becomes practically a fountain pen without the aid of the extended reservoir and other accessories of an ordinary fountain pen.

CASH RECEPTACLE.—Alpheus C. Sine, Stanford, Ky. At the foot of the main casing of this receptacle is a drawer, over which is a casing supporting a shell which holds a rotary coin carrier, where coins may be placed or from which they may be removed at will, the upper casing holding gearing by which the coin carrier is operated, and the base casing carrying a receptacle for notes and also an alarm mechanism by which notice is given when the apparatus is operated.

AXLE BOX. — Franz A. Surth, Dortmund, Germany. This invention provides novel forms of plates and ring to constitute a closure for the space between axles and the walls of the openings in axle boxes, through which openings the axles pass, the closures serving to prevent the passage of dust in such spaces and also preventing the escape of the lubricant from the axle box. The construction allows free movement of the axle box and axle.

KITCHEN TABLE.—Rudolph J. Hentze, Jersey City, N. J. This table is provided with a bin for holding flour, etc., protecting the contents from insects and dust, the bin being also so placed in the table as not to interfere with the ordinary use of the table. In the body of the table is also concealed a pastry board, which may be drawn entirely out and placed on top of the table. The table is also provided with drawers.

SHOESTRING HOLDER. — Henderson T. Small, Chanute, Kansas. This is a simple device, composed of a bracket having at one end a screw shank, the bracket being provided with a contact surface and with an elastic band sprung into seats thereon. The device is adapted to be readily applied to a cabinet or other support to hold a number of strings in such manner as to permit the ready removal of any one of the strings without displacing or disarranging the others.

FENCE WIRE STRETCHER.—John W. Schaal, Logan, O. The wire clutch mechanism embraced in this invention comprises a bar to which a series of clutches is attached, a tension bar and arms being attached to the bar and pivotally connected to the clutches, the apparatus being adapted to stretch one wire or to stretch several wires simultaneously. It is adapted for application at any point in a section of fence, whether the ground be flat or undulating, and releases the tension automatically as the pickets are inserted, or as the wires are depressed or raised for attachment to the posts.

FLUTE.—Carlo T. Giorgi, New York City. This flute has a mouthpiece curved in direction of the length of the flute, with a mouth hole on its top and a resounding chamber extending below the line of communication between the mouthpiece and the body of the flute. It has all the eleven holes necessary to the chromatic scale, each hole being adapted to be closed independently without cross fingering, and keys are not necessary. The mouthpiece is at the upper end of the pipe, along which the air is blown straight, the notes being of perfect intonation and equality of sound from the lowest to the highest.

LOCK FOR FLUSHING VALVES.—Charles H. Shepherd, New York City. Combined with the flushing valve lever, according to this invention, is a lock which engages the lever when it is raised and holds it in elevated position until released by the descent of the float ball of the supply pipe, the design being to accomplish thorough flushing when the valve is raised by a quick pull of the handle and the ordinary quick closing of the valve. This lock is of simple construction, and can be readily attached to many forms of tank and valve mechanism without making any change in the existing construction.

FIREPROOF FLOOR CONSTRUCTION.—Francis Omeis, Moultrieville, S. C. As an improvement in steel frame buildings, this invention provides for hangers suspended from the floor beams, auxiliary beams whose ends enter the hangers and are supported thereby between adjacent beams, the auxiliary beams having holes through which pass wires or rods connected to the main floor beams, while the auxiliary beams and wires are surrounded by concrete or similar material. The auxiliary beams are of novel form and may be cheaply constructed of flat plate material.

BIN.—Walter Thomas, Palatka, Fla. This invention provides an improved bin for granular foods, the bin having a novel arrangement of a number of compartments in one entire and inseparable structure, the elements of which are very closely combined, and each of which has an essential structure and relative position. The several compartments may be readily washed and cleaned.

LEMON SQUEEZER.—William H. Cox and Charles Hughes, Red Bluff, Cal. This is a simple and inexpensive device with which, by a single movement, the operator may cut a lime or lemon and extract the juice. It is so made that the lime or lemon may be cut from its bottom nearly to the top without severing the upper portion, thus preventing any upward escape of juices during the operation of compressing, and compelling all of the juices to pass out through the exit provided therefor.

MERRY-GO-ROUND.—Thomas T. Templin, Paris, Ky. This is a circular swing of simple and cheap construction, to be operated by one of the riders, and consists of two seats suspended from the ends of a pivoted beam, there being means by which one of the riders may be shifted in relation to the central post, to maintain an even balance between the two occupants, and the rotation being effected by a rope from one of the seats connected with a pulley on the central standard.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co. for 10 cents each. Please send name of the patentee, title of invention, and date of this paper.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

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Minerals sent for examination should be distinctly marked or labeled.

(7272) G. B. C. asks: 1. Can the 3 or 6 inch call bell be worked by the incandescent light wires (current about 104 volts), or should the magnets be wound especially for that purpose? A. The magnets of call bells should be wound to a very high resistance, if they are to be connected directly to a lighting circuit. 2. Should there be lamps in series with the bell, and how many? A. A bell with a lower resistance may be used in series with an incandescent lamp. 3. There are bells made especially for light current; where can they be got, and who are manufacturers of German silver wire, the size used in electric car heaters? A. Any dealer in electric supplies can furnish both bells and German silver wire. 4. Can the 3 inch diameter carbons that are used in the aluminum furnace be used for call bell batteries? A. It will work as a negative plate, but is needlessly heavy. A thin plate, ¼ inch thick, is quite sufficient.

(7273) J. L. T. says: Can a meerschaum pipe be cleaned so that it will color again by boiling in milk, or otherwise, and what is the process? A. When once burnt the pipe cannot be satisfactorily colored unless the burnt portion is removed and the surface again treated by the process by which the meerschaum was prepared. We are not familiar with the process of boiling in milk. The bowls of the pipes are prepared by soaking them first in tallow, then in wax (beeswax) and finally polishing with shore grass or silk. The pipe is preferably boiled in the wax. The oil from the tobacco is retained under the wax and gives the color. It is said that the color can be developed by careful heating, which drives the oil toward the surface. A new pipe should never be smoked out of doors in cold weather.

(7274) F. H. asks: 1. How many bichromate of potash batteries will it take to magnetize the field of the little alternating current dynamo of SCIENTIFIC AMERICAN, September 11, to light two or three 16 candle power 110 volt lamps? A. Five bichromate of potash cells will be required in series. Wind 120 turns of No. 18 magnet wire on each spool. About 35 feet. Approximately, 350 feet for the ten poles. 2. How many amperes will this little dynamo give? A. Two amperes, approximately.

(7275) O. J. asks how to make a good strong battery to use with a gas engine and to run small motors, and if there is any advantage in using copper in the place of carbon. A. The bichromate plunge battery described in SUPPLEMENT, No. 792, is a very powerful battery, one of the most powerful. It can be easily made and recharged. You cannot use copper in place of the carbon in this battery.

(7276) L. S. asks for a formula or formulas for flash light powder, for use in photography, which can be set off with fuse, and work with a minimum of smoke and noise? A. Valuable formulas for flash light powders are given in SUPPLEMENT, Nos. 1062, 1088, 1115 and 1116; price 10 cents each by mail.

(7277) C. W., writing about the small alternator recently published in the SCIENTIFIC AMERICAN, asks (1) whether the ring and armature core can be cast with as good results? If so, can they be cast with the same kind of iron as sash weights are made of, that is scrap tin and pig iron? A. No. You must use the best soft iron to be had for field and armature cores of a dynamo. Sash weights are made of the poorest quality of iron. 2. About how much wire would it take for the whole machine? A. The field spools will require about 4 pounds of wire No. 20 double cotton covered in 12 layers, 120 feet for each spool. Armature teeth must be wound with four even layers of No. 22 double cotton covered magnet wire, about 2 pounds in all, approximately 80 feet on each prong. 3. Could it be charged with four cells of the primary battery? A. No. Four cells of battery are not enough to charge the field. When wound as above it should be charged from an incandescent lighting circuit.

NEW BOOKS, ETC.

THE AMERICAN ANNUAL OF PHOTOGRAPHY AND PHOTOGRAPHIC TIMES ALMANAC FOR 1898. Edited by Walter E. Woodbury. New York: Scovill & Adams Company. 1898. Pp. 370. 8vo, 300 illustrations. Price 75 cents.

This annual, now the twelfth of the series published, appears this season embellished with a beautiful collection of the latest and best examples of process work, and is typical of the progress that has been made in this line. The book is replete with many useful articles and hints representing the experience of well known writers on photography, particularly as regards its relation to the amateur worker. Details regarding process work are fully explained, while such topics as printing, development, enlarging, lantern slide making, camera making, astronomical photography and other subjects are well treated in a practical way easily understood. Printing in colors (the tricolor process) is also described and examples shown. There is the usual collection of the best and latest formulas conveniently arranged for use. The book is in fact a necessary adjunct to the library of every photographer. The editor is to be congratulated on the improvement shown over previous issues.

CENTRIFUGAL ANALYSIS. A manual for the use of the centrifuge in everyday work. Illustrated. Rochester, N. Y.: Bausch & Lomb Optical Company. Pp. 36. This neat pamphlet is supplied gratis to persons interested in the centrifugal analyses of water, milk, urine, blood and other liquids or semi-liquids. It describes the apparatus and methods of arriving at results. The book is readable and instructive.

TO INVENTORS.

An experience of nearly fifty years, and the preparation of more than one hundred thousand applications for patents at home and abroad, enable us to understand the laws and practice on both continents, and to possess unequaled facilities for procuring patents everywhere. A synopsis of the patent laws of the United States and all foreign countries may be had on application, and persons contemplating the securing of patents, either at home or abroad, are invited to write to this office for prices, which are low, in accordance with the times and our extensive facilities for conducting the business. Address MUNN & CO., office SCIENTIFIC AMERICAN, 361 Broadway, New York.

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DECEMBER 7, 1897,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

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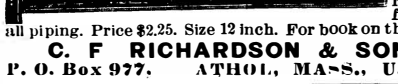

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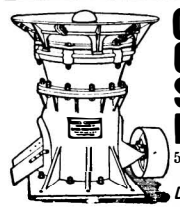

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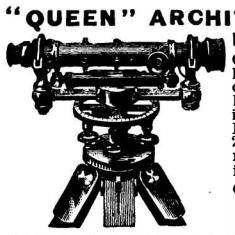

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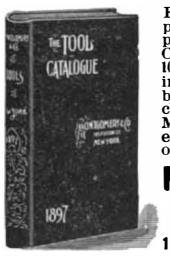

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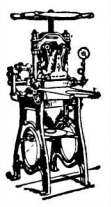

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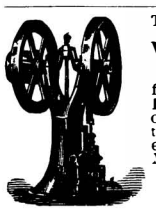

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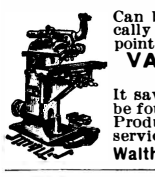

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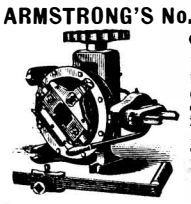

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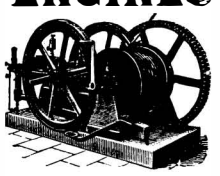

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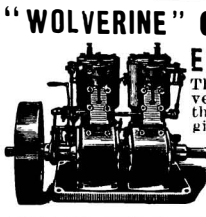

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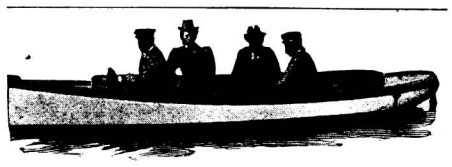

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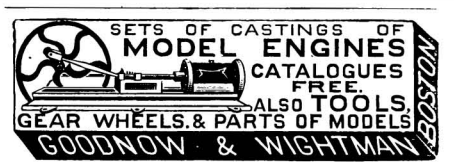

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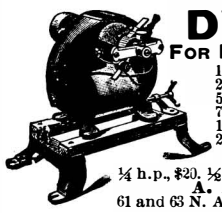

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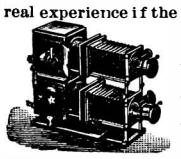

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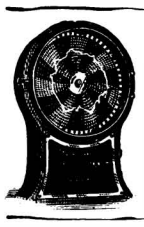

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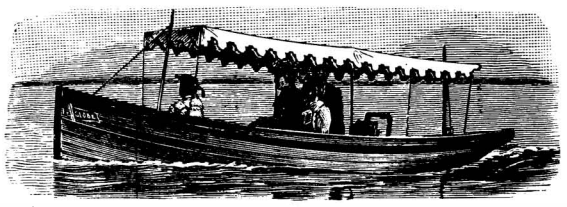

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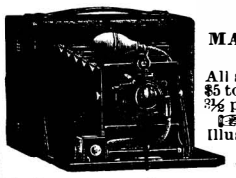

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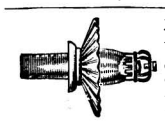

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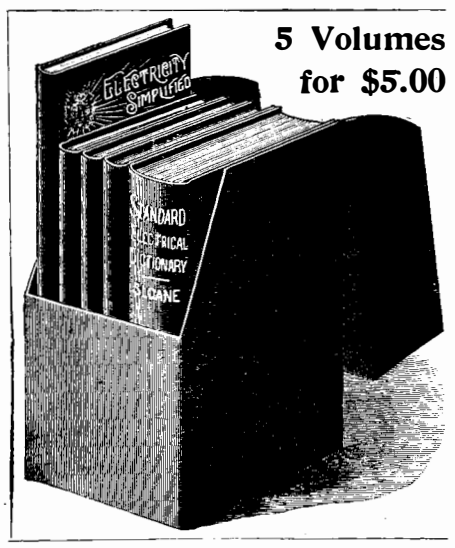

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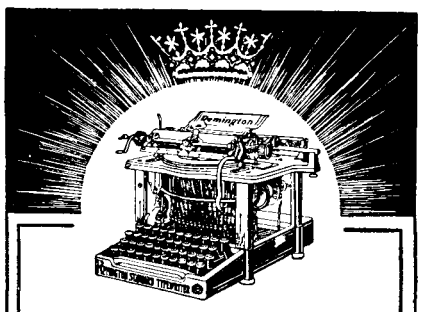

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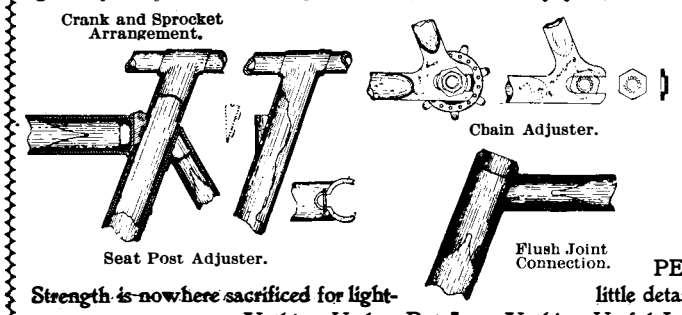

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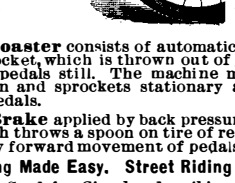

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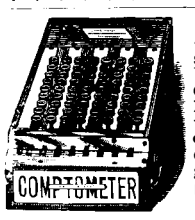

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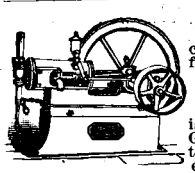

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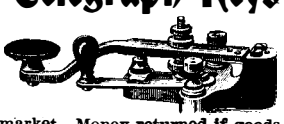

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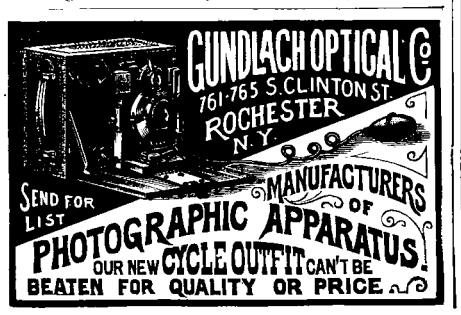

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